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NATURAL GAS.

Natural gas is being supplied over wider areas, and it comes as both an ally and a competitor of electric lighting This dual position relates to both the central station and to the isolated plant, for natural gas may displace the lamps or operate the engines of either a public or private electric system, under same conditions.

As a lighting agent at the open-flame natural gas has no value, but in incandescent mantle burners it has even greater illuminating power than good manufactured gas. It is thus only in so far as mantle burners are adapted that natural gas competes with the electric light, and the most important point of such competition for central stations is probably in street lighting.

It has previously been pointed out that mantle burners with all their supposed advantages have been able to displace the open flame of manufactured gas to only a slight extent among ordinary consumers, and it may well be doubted whether natural gas can do much more in this direction. An illustration of the preference of the public for a gas that carries its own illuminating power may be noted at Buffalo, where some 600,000,000 feet of eighteen-candle artificial gas is annually sold at one dollar per thousand, though natural gas retails at thirty-two cents.

In factories and stores and on the streets, however, there is some competition between natural gas and electric light, but this can often be offset by the use of gas as a source of power for electrical supply. The owner of a factory that will either operate an isolated electric plant or use natural gas for lighting finds the cost less and the service better if natural gas is burned in an engine instead of in mantles.

With mantle burners that consume only three-and-one-half cubic feet of natural gas each per hour, the volume required by eight burners will give a kilowatt-hour if used to drive a small gas engine and dynamo, and with this kilowatt-hour twenty tungsten lamps of forty candlepower each may be operated.

A central station that must compete with natural gas for lighting and power will often find itself armed for the conflict by using this gas under boilers or in engines. Though subject to some variation, the heating power of natural gas may be taken at 900 British thermal units per cubic foot, or 900,000 units per thousand cubic feet, which is approximately one-and-one-half times the heating power of ordinary manu-

factured gas. If a ton of 2,000 pounds of steam coal be taken to have 24,000,000 British thermal units, 26,600 feet of natural gas should make more steam than this coal, for the gas can be burned under boilers with a higher efficiency.

Even better results may be had if gas engines are used to drive the electric generators, for it would not be unreasonable to expect an efficiency of thirteen per cent, including friction losses, under reasonable conditions of load. This should give twelve per cent of the heat energy of the natural gas in the form of electric current at the dynamo terminals, or, say, thirty-one kilowatt-hours per thousand feet of the natural gas used in engines. In other words, a combined gas engine and dynamo should deliver $900{,}000 \times 0.12 = 108{,}000$ heat units per thousand feet of natural gas consumed, and 108,000 divided by 3,412, the number of equivalent heat units per kilowatt-hour, gives thirty-one kilowatt-hours per thousand feet of gas.

In the wide area between Pennsylvania and Oklahoma where natural gas is sold the rates to small consumers range from about fifteen to fifty cents per thousand feet, while the rates to factories and other large users are often as low as three, five, eight or ten cents per thousand feet. With thirty-one kilowatt-hours per thousand feet of natural gas at the rate of three cents, the fuel cost amounts to less than one-tenth cent per kilowatt-hour, and even at the rate of ten cents per thousand feet the cost of gas is no more than one-third cent per kilowatt-hour, where gas engines are used. On the basis of the above conclusion that 26,600 cubic feet of natural gas will more than equal 2,000 pounds of steam coal under boilers, the cost of this gas to replace the short ton of coal is $0.798 at the rate of three cents, and $2.66 at ten cents per thousand feet.

Where a central station is operating with a steam plant and coal for fuel, it may or may not be advisable to install gas engines for use with natural gas, according to the price of the gas and the prospect of a permanent supply. Even if the cost of natural gas used under boilers nearly equals that of coal, the saving of labor in the fire room and the ability to instantly increase or decrease the gas heat may warrant its introduction.

Of course, an electric station has a legal right to as low a rate for natural gas as any other consumer of a like amount, even though there is competition in lighting.

ELECTRIC POWER FROM ENFIELD RAPIDS.

From the foot of the Holyoke Rapids to Long Island Sound, a distance of some eighty-three miles, the Connecticut River falls thirty-eight feet, and most of the power there available has gone undeveloped from the beginning of time. Now, however, it is reported that a hydroelectric plant is to be located at the Enfield Rapids to absorb a large part of this power.

As one travels from Springfield to Hartford along the banks of the Connecticut River, the low Enfield dam may be seen across this river at a point a little downstream from the railroad station at Thompsonville, Conn., marking the head of six miles of rapids that end at Windsor Locks.

On the west bank of the Connecticut, in the town of Suffield, a canal opens at that end of the dam and parallels the river to Windsor Locks, where it discharges at the foot of the Enfield Rapids. This canal is available for navigation by light craft, but its principal present use is for the supply of power to a number of factories that are located between the canal and the river, at Windsor Locks.

At best, however, the present canal appears to deliver only a fraction of the normal flow of the river to waterwheels, and its capacity for storage is small. Furthermore, while water can now be delivered only to plants on the bank of the canal, the service of a hydroelectric plant would extend over its radius of transmission.

In 1880, when the canal had been in use for half a century, the capacity of all the waterwheels set at Windsor Locks was only 1,800 to 1,900 horsepower, but it appears that the discharge of the Connecticut River with the head there available might develop ten times this power during a great part of each year.

The dam, canal and locks at Enfield and Windsor Locks were first constructed about the year 1830, but have since been in part rebuilt. As improved some years ago, the canal had a center depth of six feet and a width of 180 feet at the water line. When first constructed the main purpose of the canal was that of an aid to navigation by carrying boats past the Enfield Rapids, but the railroads made it unprofitable to run the small boats that the canal would carry, and thus limited its main use to the development of power.

If the purposes of navigation are now to be served in an effective way, it seems that either the size of the present canal must be much increased, or an entirely new canal constructed, or else that a dam at or below the foot of the rapids must be employed to set back the water to the top of the present Enfield dam. One or more locks at such a dam would, of course, transfer boats between the higher and the lower level.

Without assuming to pass on the relative desirability of the several means by which the facilities for navigation may be increased and a great addition be made to the power developed at the Enfield Rapids, it may be noted that the river lies between high banks from Thompsonville to Windsor Locks, so that the amount of flowage created by a dam that flooded the rapids would be small. An obvious advantage of such a dam in a plan for the development of power on a large scale is the storage area that it would create along the six miles of rapids.

While a large storage area is desirable in connection with almost any hydroelectric development, such storage is particularly desirable on the Connecticut River, because of the great and rapid fluctuations in its rate of discharge. Unfortunately, no records of the rate of discharge of the Connecticut River at Hartford have been found for recent years, but public records were kept between 1871 and 1878, inclusive, and show a mini-

mum of 5,208 cubic feet per second and a maximum of 139,410 cubic feet.

In May, 1854, when the highest freshet ever known on the river occurred, the height of the water at Hartford was twenty-nine feet, eleven-and-one-half inches above its lowest recorded elevation, and the rate of discharge was estimated at 205,464 cubic feet per second. At Hartford, ten miles below the foot of Enfield Rapids at Windsor Locks, the drainage area of the Connecticut River is 10,235 square miles, but it receives two tributaries, the Scantic River and the Farmington River, between these two points.

From the top of the Enfield dam to the foot of the rapids at Windsor Locks the fall of the Connecticut River is thirty-two feet at times of fairly low water, but this head is decreased when the river is in flood. As the mills are ranged along the bank of the river, opposite the lower end of the rapids, most of them are able to obtain an effective head of less than thirty feet on their wheels, and all draw water from the canal at the same level. At the end of the canal, below the mills, there are three locks for the transfer of boats to and from the river.

During the eight years from 1871 to 1878, according to the Report of the Chief of Engineers, United States Army, for 1878, the lowest rate of discharge was 5,208 cubic feet per second, and the average of the lowest rate in each of the eight years was 5,538 cubic feet per second. For the eight years just named the average of the entire discharge of the river was 20,208 cubic feet per second.

If it be assumed that the development of the Enfield Rapids for a hydroelectric plant would make thirty feet of the possible thirty-two feet of fall available at the wheels, then each 1,000 cubic feet of water used per second would develop a total of 3,404 horsepower, from which all wheel, generator and transmission losses must be deducted to determine the net delivered power.

With 5,000 cubic feet of water per second passing through the wheels, the gross horsepower would be 17,020, and if it proved to be advisable to utilize 10,000 cubic feet per second the gross power of the water would amount to 34,040 horsepower.

As sixty per cent of the gross power of the water used in wheels may be transmitted and delivered to consumers under fair conditions of economy, it may be assumed that with a hydroelectric plant using 10,000 cubic feet of water per second at Windsor Locks, some 20,400 horsepower may be supplied to consumers in the form of electric energy.

Even if it be found desirable to give the above plant a capacity to handle 10,000 cubic feet of water per second, there appears to be a ready market within a moderate radius of transmission for more power than this flow of water will develop. Hartford is only ten miles and Springfield less than twenty from the foot of Enfield Rapids, and in each of these cities the electrical supply systems are operated in large part by steam power, besides which many factories are driven entirely by steam. Strike a radius of twenty-five miles about Windsor Locks and not only Springfield and Hartford, but also Manchester, Rockville, New Britain, Berlin and a number of other manufacturing centers are included.

From the above figures it may be noted that the prospective power available at the Enfield Rapids surpasses that of any existing hydroelectric plant in Connecticut, the nearest approach to it in point of volume being that at Bull's Bridge, on the Housatonic. At the Bull's Bridge plant the head of water is about 110 feet, the highest at any large hydroelectric plant in New England, but the discharge of the Housatonic there during 1906, which was rated as a good year, was only 296 as a minimum and 1,670 as the mean number of cubic feet per second.

With only thirty feet of head at Enfield Rapids, a minimum of about 5,000 and an average of nearly 20,000 cubic feet per second carry the possible power much above that at Bull's Bridge.

SCHOOL-HOUSE LIGHTING AND POWER RATES.

By a recent ruling that the Edison Electric Illuminating Company of Boston need not supply current to the school houses of that city at rates lower than its established charges, the Massachusetts Gas and Electric Light Commission has set a precedent which is liable to be turned to excellent account by central stations wrestling with the question of municipal power and lighting prices. In a most carefully drawn statement the commissioners state that if they should order the company to supply current to the Boston School Committee at reduced rates, the result would be nothing short of discrimination. The board recognizes the tendency of many municipalities to take the position that having granted the public-utility corporation locations in the public ways, or under them, a reduction in charges is deemed to be a logical return for the privilege. This point of view receives a severe setback in the commission's opinion, which states that the officers of any municipality in granting a location in or under the public ways are really acting as agents of the state for the general public welfare, since only on the grounds that a location is for the public interest as a whole can such a location be properly granted. This is sound doctrine and worth bearing in mind.

A specious plea of the Boston School Committee was that the size of its load justified a reduction from the company, but the commission punctured this bubble with the technical ability which its long experience has conferred. The combined load of all the school houses was indeed considerable, but practically this load represents a scattered installation of transformers and distributing mains feeding points so far apart that little if any physical relations exist between them except at the power station busbars. The company would not be expected to supply power at wholesale rates to a private consumer owning factories from five to ten miles apart, on the basis of their combined load, and so the commissioners ruled in regard to the schools. A decided stand of this kind is gratifying to central stations and should be generally helpful.

Annual Meeting of the Electrical Trades Association of Chicago.

The fiscal year of the Electrical Trades Association of Chicago ended October 31 and has been one of extraordinary accomplishments. The membership of the Chicago association embraces representative electrical manufacturers and jobbers in the territory from Cleveland to Denver and from Detroit to New Orleans and numbers 210 strong. These members are co-operating with the manufacturing and jobbing members of the associations located in Boston, New York, Philadelphia and San Francisco, about 425 in all, in the confidential exchange of ledger facts upon which the credit of customers is predicated. One of the incidental features of the association has been the large number of accounts adjusted by use of the association forms, amounting to a million dollars annually. But the adjustment and collection features are regarded as purely incidental, the main objects of the association being to protect the mutual interests of the members, secure uniformity and certainty in the customs and usages of electrical trade and commerce, to settle differences among its members and to collect and distribute confidential trade information to save the members from making unsatisfactory credits.

The fourteenth annual meeting and dinner will be held this year on Friday evening, November 12, at the University Club, Chicago, and will be without doubt the biggest function ever promoted by the organization.

Charles E. Brown, of the Central Electric Company, will act as toastmaster and will introduce the following speakers: Samuel Insull, president of the Commonwealth Edison Company; H. E. Hackenberg, treasurer of the National Carbon Company; James Wolff, president of the National Electrical Trades Association; Hon. William F. McSurely, judge of the Superior Court of Cook County; and Charles E. Kremer, wit of the Chicago Bar. Benson's Orchestra will be the accompaniment for the maennerchor musical features.

During the past thirteen years the association's influence for the general good of the trade has been felt throughout the country. It has, at all times, had as its executives the leading men in the electrical trade, who have at heart the interests and welfare of this particular line of industry, and whose able administration has done much to promote cordial feeling among the members and by the safe and sane operation of the association has commended it to the electrical buying public, irrespective of membership. Trade frauds have been detected and exposed, and the territory has been made a safer one in which to trade freely. The credit of customers generally has been more accurately determined, with the result that losses have been minimized and profits have correspondingly increased.

Since the organization of the association in the fall of 1896, Frederic P. Vose, Marquette Building, Chicago, has been the secretary, and his office has been long recognized among the electrical manufacturers and jobbers as the credit center of the trade.

While the association has great power, it has never been used tyrannically. Everyone receives a square deal, as it has never been the intent to do an injustice to anyone, and this intent has always characterized the actions of the association and has done much in widely establishing its reputation for the welfare of the trade throughout the country.

The Next Chicago Electrical Show.

There is every reason to believe that the next Chicago Electrical Show, to be held in the Coliseum from January 15 to 29, 1910, will be the most successful and interesting of the several shows the Electrical Trades Exposition Company has given in Chicago. The demand for space is far ahead of any previous year at this time, and many leading concerns have taken more space than heretofore with the idea of making larger exhibits. Contracts have already been signed with the following concerns: American Steel and Wire Company, Crane Company, Swedish-American Telephone Company, Duntley Manufacturing Company, Pelouze Electric Heater Company, General Vehicle Company, Driver-Harris Wire Company, Hurley Machine Company, Neville Illuminating Sign Company, Electric Cleaner Company, National Acme Manufacturing Company, Keller Manufacturing Company, Hinde & Dauch Paper Company, Simplex Electric Heating Company, Grand Ledge Clay Product Company, Hoskins Manufacturing Company, Mathias Klein & Sons, Appleton Electric Company, Vulcan Electric Heating Company, General Electric Company, National Electric Lamp Association, Westinghouse Electric and Manufacturing Company, North Shore Electric Company, Commonwealth Edison Company, Chicago Telephone Company and The Electric Shop.

It is believed that before the end of December every available foot of space will have been taken. D. H. Burnham & Company, the architects, are working on a new scheme of decoration which it is thought will surpass anything disclosed in former shows in the way of attractiveness and brilliancy. Horace Wild, Chicago's young aviator and electrician, wants to put a cigar-shaped balloon under the roof of the building, the movement of which he will direct by Hertzian waves from a station in the balcony. The balloon is to be gas-filled and motor-driven. Mr. Wild claims that his demonstration will show the value of dirigible balloons, controlled by wireless, in modern warfare.

Cleveland Electric Club Entertains.

The Cleveland Electrical League, composed of the leading electrical interests of Cleveland, Ohio, tendered a very successful luncheon to its members on Saturday noon, October 30. H. H. Cudmore, president of the Brilliant Electric Company, and secretary of the League, presided in the absence of President G. E. Miller.

The speaker was W. A. Warner, of the Warner & Swasey Company. Mr. Warner took for his subject the use of technical instruments in polar observations. In view of the keen interest now attaching to this subject, Mr. Warner was greeted enthusiastically and listened to attentively. With a few simple drawings on a blackboard, Mr. Warner showed how it would be possible for anyone of ordinary intelligence, with simple instruments, to tell when he had arrived at the North Pole.

"The question of the discovery of the pole comes down to a matter of the reliability of the explorer, as I understand it," said Mr. Warner. He told of his visit to the North Cape and the observations of the midnight sun.

"There is no ground for a question on the part of the explorer, and it is simply a question of his word," continued Mr. Warner. "As I understand it, neither Dr. Cook nor Commodore Peary had competent witnesses with them, and no number of scientists can settle the question, because the records of the explorers will have the same reliability as the word of the men, no more, no less."

The League will hold regular luncheons throughout the season, and an active committee is formulating plans to keep alive the great interest which is now being demonstrated.

The Chicago Electric Club.

The Chicago Electric Club was entertained at its regular meeting on Wednesday, October 27, by George B. Caldwell, manager of the bond department of the American Trust and Savings Bank, who addressed the club on the subject of "Electrical Securities as Investments."

In the building of great electrical plants, a question more fundamental than that of technical means and methods, is, in Mr. Caldwell's opinion, "How shall the enterprise be financed?" It is in considering this question that the electrical men representing progressive ideas and the banker handling bonds meet on common ground and ask another question, "What is the attitude of investors toward electrical securities?"

In dealing with the subject of the elements which are essential to a marketable bond on an electrical plant, Mr. Caldwell named the following points: It must not be overbonded, if the bonds are to be sold to the public; it must have good management; it must have a depreciation reserve or sinking fund and honest accounting.

Continuing, he said that the attitude of the investor is one seeking security first, income next, and finally convertibility. In this respect electrical securities are not different from those of other corporations, the only difference being that electricity is still regarded as an element that is less understood than most any other public utility. However, it is growing very fast in public favor for power and lighting. Yet with this in its favor, the feeling exists that it has not yet been fully developed and that the methods employed for its production and distribution are rapidly changing. The refusal of most investors is based not alone on the plea that the apparatus required to produce electricity wears out rapidly, but that it has not yet become standardized, thus making an additional risk and double depreciation.

Mr. Caldwell asked that the electrical men and the bankers engaged in financing should work hand in hand to the end that tests as to the durability and productive power of all modern electrical plants should be clearly and conservatively determined, and the facts freely distributed, if the securities are to be sold to the public.

Another thing regarding the marketability of electrical securities that the speaker emphasized was that the census report of 1892 showed that the average cost per electric plant was $140,000, while in 1907 it was $200,000. The eleven or twelve hundred millions of dollars invested in electric-lighting and power plants is divided among some 8,000 or 10,000 separate companies with a net earning power of fourteen per cent on the capital invested. Consequently there are a great number of small individual plants unrelated in management or corporate organization. It is obvious that one must have a very specialized information to be the judge of the character of these innumerable different issues of bonds and stocks, and that the stocks in but a few instances pay dividends, while bond issues, even though conservative, lack convertibility, which is but another word for marketability.

The speaker asserted that the business of manufacturing and selling of electrical energy has been almost uniformly profitable. Yet it has become so only after encountering many expensive obstacles both in engineering and financing. So much progress has been made, however, that the bond issue of a modern electric-light plant in any city of 50,000 and over is regarded as only an ordinary business hazard. Mr. Caldwell said also that in his opinion the utilization of the great waterpowers also tends toward a combined management covering large areas, and has already worked great results in the matter of long-distance transmission.

At the conclusion of the address the question of what routine was generally followed in lending money on bonds was asked the speaker. Mr. Caldwell replied by citing numerous instances, bringing out the point that the bonding department of any bank earnestly solicits the co-operation and assistance of the electrical men in determining the actual value from the operator's standpoint.

Another question asked was, why, in nearly every instance, is the denomination of a bond $1,000 or more, which in frequent cases limits the market of the bond in certain communities. Mr. Caldwell replied that the denomination of the bond rests entirely with the party or corporation seeking same, and in frequent cases where the bonds were to be sold in a certain community were made as low as $50 or $100. From the bank's standpoint, however, bonds of $1,000 denomination were preferable, because they occupy less space than numerous bonds of smaller denomination, and hence the system of keeping account of them is necessarily much simplified.

Convention of the Railway Signal Association.

The fifteenth annual convention of the Railway Signal Association was held in Louisville, Ky., October 12, 13 and 14. The meetings were well attended, a number of excellent papers were presented, followed by lively discussions, and the reports of the various committees were thoroughly digested and accepted.

The convention was opened Tuesday morning by the president, who delivered his annual address, called on the secretary for various unfinished business, and for the reports of the following committees: Report of the committee on mechanical interlocking, power interlocking, automatic stops and cab signals, subjects and definitions, and the report of the special committee on storage batteries.

Wednesday was devoted to the reading and discussion of the report of the committee on signaling practice and the report of the committee on automatic block signaling.

The meeting on Thursday was devoted to an extended discussion of the report of the special committee on wires and cables and the report of the special committee on lightning arresters.

At the Thursday afternoon session the selection of the place for the next meeting was discussed, and it was decided to leave it to a letter-ballot by the association, with the suggestions that Atlantic City, N. J., was first choice, Washington, D. C., second, and either Niagara Falls, N. Y., or Old Point Comfort, Va., third. The following elections of officers for the ensuing year were announced: H. S. Balliet, president; C. E. Denney, first vice-president; C. C. Anthony, second vice-president; C. C. Rosenberg, secretary.

Elaborate entertainment features were provided, particular attention being paid to the ladies whose time was occupied during the sessions of the association. The annual Louisville Horse Show was held during the week of the convention, and many of the delegates, guests and ladies took advantage of this form of entertainment. On Friday, those who remained, enjoyed a delightful trip to Mammoth Cave.

Extensive exhibits were made of railway signal equipment and supplies.

Copper Exports.

Exports of copper for the week ended October 28 were 4,368 tons. Since October 1 they were 21,615 tons compared with 19,977 tons the same period last year.

New York Electrical Society.

At the 288th meeting of the New York Electrical Society, held at the Engineering Societies Building, October 27, G. Herbert Condict read an excellent paper on "The Handling of Freight at Terminals by Electricity." The possibilities of telpherage were exhaustively considered, and a large number of slides showed the progress which had been made either in existing installations, as well as situations in which telpherage could economically and effectively be introduced.

The discussion was extremely interesting, being contributed to by T. C. Martin, Edwin B. Katte, George R. Larwill and C. O. Mailloux, who gave a masterly review of the history of telpherage and of its developments up to the present. This was effectively supplemented by an admirable talk by H. McL. Harding, who showed graphically the industrial possibilities of handling freight by electricity.

The following members were elected: Dr. Frederic deKraft, F. H. Wappler, Dr. Byron S. Price, Henry Haywood, Jr., J. C. Hubbard, Charles H. Terry, Cloyd Marshall, Fred Bliss, Jr., Douglass S. Warren and Frederick M. Sammis.

Steam and Electric Roads.

Whether or not steam railways shall cooperate physically with electric lines is a question which has been presented to the Interstate Commerce Commission, and will shortly be argued at Cincinnati.

The case at issue is of unusual importance and significance, because up to the present time the steam railroads of the country have refused absolutely to enter into any arrangement with electric lines for through routes and joint rates, either for freight or for passengers. The law does not explicitly require physical connection between two railroads—either steam or electric—but it has been the policy of the commission in interstate business to require such connection to be made between two steam roads where the conditions appear to demand, or even to warrant it.

The making of through routes and joint rates, for both freight and passengers, naturally follows the physical connection of the two roads.

The extensive construction and operation of electric lines has increased the demand for their connection with steam railroads. Many of them have endeavored to effect a joint arrangement with steam roads, but in practically every instance the efforts have been of no avail.

New $50,000,000 Telephone Company Chartered.

The Continental Telephone and Telegraph Company has been incorporated at Trenton, N. J., with an authorized capital stock of $50,000,000. This is to be divided equally into common and preferred stock, the latter bearing six per cent noncumulative dividends. In the event of the earnings exceeding the amount necessary to pay the preferred stock dividends, the directors may declare dividends of not more than six per cent upon the common stock. Any excess of earnings declared is to be divided equally between the common and preferred stock.

Among the objects specified in the charter are to unite and consolidate telephone, telegraph and cable lines, and the right to do so is made part of the charter powers of the company. The directors are also given authority to issue bonds convertible into preferred stock at par. When such convertible bonds have been issued the directors are required by the charter to set aside an amount of preferred stock equal to that of the convertible bonds and to be used for no other purpose until the time limit has expired within which the bondholder is given the option of making the exchange for the preferred stock. The common stock is alone vested with a voting power.

Specific authority is given to consolidate or merge with any corporation engaged in a similar business, and the consolidated company may be any one of the merging companies or a new corporation to be formed by means of such consolidation. The directors are given power to remove any officer of the company elected or appointed by them by a majority vote.

The incorporators are: William M. Clark, of Plainfield, N. J.; Powell Crichton and William E. Conley, of New York. The charter was filed by Philbin, Beekman & Menken, of New York.

Ohio Telephone Deal Completed.

The incorporation of the Ohio Home Telephone Company at Columbus, Ohio, for the purpose of leasing the property of the United States Telephone Company brings to a close negotiations which have been in progress for over a year looking toward a merger of all the independent telephone interests in the state of Ohio. An amalgamation of all the independent telephone interests in the country is anticipated as an outgrowth of the Ohio organization.

Stockholders of the local companies are the stockholders of the Ohio Home Telephone Company, which, it is said, will render it impossible for outside interests to obtain control of the independent long-distance service and thus cut off local companies from outside telephone connections. The new company was incorporated for $500,000.

Mackay Companies.

Extensions of the Postal Telegraph Company in the western mining regions and the efforts of the Mackay Companies to improve the service on the Pacific Coast is a principal reason for the present inspection tour of President Clarence H. Mackay, it is asserted. With associates, Mr. Mackay is now in the western section of the country. The party is expected to return in about two weeks. Special construction work from Salt Lake City to Sacramento has been under way during the past year, with the result that an additional transcontinental line will soon be ready for business.

The Mackay Companies experienced prosperous business during 1908. Notwithstanding the fact that the earnings of the Commercial Cable Company showed a decrease because of the disruption of the submarine cables through powerful steam fishing vessels operating their deep-sea nets, the general revenues increased. Since the improvement in business, the telegraph companies included in the Mackay system have shown monthly increases in net earnings, and it is expected that the next annual report, to be issued in February, will prove that all the subsidiaries have contributed materially to the earnings of the holding company.

Last year's income from investments in subsidiary companies netted the Mackay Companies $3,685,761, of which $2,000,000 was paid in preferred dividends, and $1,655,216 in common. There are included in the holding company 102 subsidiaries. It is part of the plans of the company to give its interests wide distribution, so as to minimize the effect of any decrease in profits from one particular source.

An Old Patent Suit Ended.

Judge Hough, in the United States Circuit Court at New York, has denied the application made by former Justice Alton B. Parker, for a reargument of the motion to confirm the report of Arthur Masten, special master, made in the action brought by George Harrington and others against the Atlantic & Pacific Tele-

graph Company and George J. Gould and other executors of the estate of the late Jay Gould.

The special master awarded damages to the complainants of $1,622,000. The action concerned a duplex and quadruplex telegraph patent which was transferred by Thomas A. Edison and Harrington to Gould and by him turned over to the Atlantic & Pacific Telegraph Company. This transfer was made in 1874, and the value of the patent at that time was said to be $4,000,000.

The complainants alleged that because of the Atlantic & Pacific Telegraph Company getting possession of the patent in that way the stock was increased in value from $18 a share to $60 a share.

Meeting of the Central Electric Railway Association.

The regular bi-monthly meeting of the Central Electric Railway Association will be held in the Palm Room of the Claypool Hotel, Indianapolis, Thursday, November 18. Members of the association residing in Michigan, Ohio and Kentucky will come to the meeting in special cars.

The programme for the meeting has been prepared with special care and embraces a number of papers on interesting and important subjects. The forenoon session will be devoted to routine business matters and reading of the reports of the committees.

The afternoon session will open with the reading and discussion of a paper prepared by J. G. Callen, of Boston, on "Centralized Testing Organization; Its Function in the Management of Electric Railways." The subject of the second paper is "Publicity," and will be read by A. D. B. Vanzandt, of Detroit, publicity agent for the Detroit United Railways.

E. C. Carpenter, of Anderson, will present the importance of a "Claim Adjusters' Association," and J. B. Crawford, of the Winona road, of Warsaw, will speak of the "Transportation and Traffic Association." S.

Plan New Subway to Carry Packages.

The Public Service Commission of New York, recently received from the law firm of Kraukoff, Harmon & Mathewson a letter relative to the contraction of a tube subway system in various parts of the city, to be operated for the carriage of parcels and packages either by compressed air or electricity.

No details were suggested in the letter of the lawyers, but the statement was made that L. B. Stillwell, president of the American Institute of Electrical Engineers, and Edward Carson, engineer-in-charge of the construction of the tunnel connected with the Boston subway, would confer with the commission as to the plans for construction and routes.

An experimental section of 1,200 feet of tube was built by the New York Subway Company, at Elizabeth, N. J., and special demonstrations of the workings of the system were made, to the satisfaction of the backers of the enterprise. Important banking interests are said to have recently become affiliated with the company and are proposing to go ahead with a comprehensive scheme of contraction.

New York Edison Company Offers Power.

One result of the debt-limit decision of the Court of Appeals which will permit New York city to build new subways at its own expense has been the receipt by the New York Public Service Commission of an offer by the New York Edison Company to submit bids for the power supply of future subways. The suggestion made by the company is that in specifications for the building a clause should be inserted providing for buying current instead of maintaining independent plants. The Interborough spent between $6,000,000 and $7,000,000 for its plants. It is estimated that the power plant for the Broadway-Lexington Avenue line will cost from $7,000,000 to $10,000,000. The company argues in its letter to the commission that, instead of sinking such a large sum in a plant, the city would be benefited by buying the power from the company. The commission has replied that it will consider the suggestion at once.

Smoking Cars Abandoned.

The Chicago & Oak Park Elevated Railroad, familiarly known as the Lake Street "L," on November 1 abandoned the setting apart of a car on each train for the use of smokers. The cars which formerly were so used were the motor cars at the front of each train. No change has been made in these cars, and they are still confined almost exclusively to male passengers. The road expects, however, to be enabled thereby to give its female passengers more seating room when the second car of its numerous two-car trains is completely filled. The rule of "no smoking" has been carried out quite generally since it was promulgated, but it is doubtful whether it will be followed by the other elevated railroads of Chicago who declare that the provision of a separate car for smokers is necessary.

Annual Banquet of Commonwealth Edison Branch of National Electric Light Association.

The annual banquet of the Commonwealth Edison Branch of the National Electric Light Association was held at the Lexington Hotel, Michigan Avenue and Twenty-second Street, Chicago, on Thursday evening, October 28.

The three hundred members and guests were entertained by Frank W. Frueauff, of New York, president of the association, and Samuel Insull, president of the Commonwealth Edison Company and former president, who were the speakers of the evening. George H. Jones, president of the local branch, presided at the dinner, and then turned the direction of affairs over to Louis Ferguson, another former president of the association, who acted as toastmaster. John W. Ferguson was chairman of the entertainment committee.

Metropolitan Lease of Forty-second Street Railway

Messrs. Joline and Robinson, receivers of the New York Metropolitan Street Railway Company, recently asked Judge Lacombe for instructions as to what action they should take on the petition of the Forty-second Street and Grand Street Ferry Railroad Company that they elect within a time to be fixed by the court whether or not they, the receivers, should adopt the lease of the road made April 6, 1893, by the Metropolitan Crosstown Railroad Company providing for a rental of $134,640 and taxes and assessments.

Replying to the request of the receiver, Judge Lacombe, in an opinion filed last week, said: "The rent reserved upon the lease, eighteen per cent upon the outstanding capital stock, may have been reasonable when the lease was executed, but under existing conditions it is grossly exorbitant. The court is not without hope that before many months the property may pass out of the receiver's hands Upon sale or otherwise it would seem very unwise to encumber it with any such burdens for the future. If petitioners think they can show that there are some special reasons why they continue the stipulated rental without adopting the lease, even at a preposterous price, they may take an order sending the matter to a special master to take testimony."

ILLINOIS STATE ELECTRIC ASSOCIATION.

CONVENTION AT ALTON, ILL., OCTOBER 26, 27 AND 28.

The annual convention of the Illinois State Electric Association was held in Alton on October 26, 27 and 28, and in point of number of members attending was the best that has been held by the association. The weather was ideal throughout these three days, and this doubtless helped the attendance. The headquarters of the association were officially at the Illini Hotel. A well-balanced programme was arranged and carried out according to schedule. The papers presented were not numerous, but were well received. The discussions were spirited and covered many phases of the subjects involved. Some of the suggestions made were shown to be generally applicable, and in other cases applicable only to the towns in which the respective companies were using them.

The first session of the convention was assembled in the City Council chamber on Tuesday afternoon. Mayor Beall, of Alton, delivered a pleasant address of welcome, to which President F. M. Sinsabaugh appropriately responded on behalf of the association. The convention then adjourned and many of the delegates took advantage of the opportunity to visit the Illinois Glass Works, one of the principal industrial establishments in this portion of the state.

In the evening a smoker and musical was given at the Elks Club. Many good speeches were made and rejoinders that were quite humorous.

WEDNESDAY MORNING SESSION.

Wednesday morning the convention got down to the real business before it. The meeting was again assembled in the City Council chamber, with President Sinsabaugh in the chair. The committee on membership reported eleven new applications, which were favorably acted upon.

Two papers on the subject of rates were presented. The first was by W. J. Whetzel, of Eureka, on "Lighting Rates in Small Towns" and the second by M. G. Linn, of Bloomington, on "Lighting Rates in Towns of Over Fifteen Thousand Population." These papers are abstracted below.

Mr. Whetzel pointed out in his paper that there was considerable variation in the rates and methods of charging now in vogue. The industry would be much benefited by greater uniformity. In a small town it is particularly necessary to have a simple system of rates. Some of the principal elements affecting the determination of the cost of current were given under the heads of standing costs or fixed charges and running or operating costs. A well-equipped small station requires an investment of about $200 per kilowatt of equipment installed. The standing costs should be about fifteen per cent of this, or about eight cents per kilowatt hour, for a consumer who uses only this amount per day. To this must be added the operating cost, thus requiring a dual rate. A number of systems of this kind were described, especially the plan of having a minimum charge plus a straight rate per kilowatt-hour, and the plan providing for a maintenance charge plus a straight rate. The author regarded the latter as the better one. It is easily computed by multiplying the number of kilowatt-hours by ten and adding fifty, which gives the total bill in cents. The giving of ten per cent discount for prompt cash payment was also encouraged.

Mr. Linn's paper was a strong argument on the equity of the double-rate system for larger towns. It is fair both to the consumer and the company. It encourages the long-burning customer, whether large or small. The primary rate must first be determined from the amount of the investment. For ease in figuring, it is frequently assumed to apply to one hour's daily use of the connected load. In determining the secondary rate, the cost at the customer's meter should be taken instead of the switchboard cost. Special rates should be eliminated as far as practicable. It is much better to reduce the rates in accordance with the growth of the station's output and the accompanying reduction in generating cost than to wait for city councils to regulate the rates. Those plants which have low rates are the ones that are doing the largest electrical business and showing large net profits. The introduction of the tungsten lamp should not prevent reduction of rates, as there are some large companies that have found it expedient to reduce their rates, in spite of diminished current consumption, due to the use of the more efficient illuminant.

After the reading of the two papers a general discussion on the subject ensued. This was opened by Elmer Smith, of Kewanee, who said too little attention was given to the costs by station managers. Very few knew just what cost they were producing their current at. A switchboard meter was the only means of telling just what was going on. He would divide the cost into three parts, viz., station expense, distribution and general expense. The best thing is to increase the power load, and in order to do so to make a price that would be an inducement for power users, especially if they could be made to yield an off-peak load.

J. F. Gilchrist, of Chicago, said that the larger companies were coming to a uniform rate for current, but a uniform rate for all companies would not do, as in various towns the costs varied considerably, such as the costs of fuel and labor with various local conditions. A uniform basis of charging should be arrived at by all companies, however. Two factors are needed to get the actual cost to the company, viz., the amount of the investment and the cost of operating. A large number of the association's members should get together and see if some equitable basis of charging for current could not be arrived at. Two ways of determining the primary rate are by charging (1) for connected load and (2) for maximum load, or assumed maximum load. Charging for connected load was not fair for residence districts, as they seldom used over twenty to thirty per cent of their connected load, while commercial houses commonly run at sixty to seventy per cent load factor. The most reliable way to get the maximum load is with a maximum-demand meter, but the cost of these increases the investment charges. The Commonwealth Edison Company, with which Mr. Gilchrist is associated, had compiled data on the average results from 30,000 demand meters that it had in service and these are available for any member interested. This company is not now using demand meters on loads of one kilowatt or less. He held that the ratios of demand to connected load that were found in Chicago would hold good all over the state in the same class of buildings, or buildings used for the same purposes. A series of cuts in the rates by his company in the last four years have reduced them from twenty cents to twelve cents for the high part and from ten cents to six cents for the low rate. In the meantime, however, the business had increased rapidly and the reduced rates had doubtless much to do with it. Mr. Gilchrist thought the manufacturers should make a lower priced meter for the small user. With the advent of the tungsten lamp it was not impossible for a consumer to use only one kilowatt, and the present costs of meters increased the cost of investment per kilowatt to too high a figure.

J. R. Cravath, of Chicago and Lawrenceville, said that his company had based its charges on the number of occupied rooms multiplied by 1,200 watts, which was charged for at a rate of fifteen cents per kilowatt-hour, and the excess at six cents. This is the Detroit plan and works out excellently for residence lighting. It does not put a penalty on the use of convenient lights, which are so useful in bathrooms, closets, and other places where they are used only a few minutes at a time, that the plan of charging for the connected load would do. Commercial business is charged at the

same rate, but runs at a higher percentage of connected load.

The discussion then turned on the scheme of giving discounts for prompt payment of bills. Mr. Davis said he had given up a collector and got better results by giving the customer the discount. Some members stated that it cost two-and-one-half to ten per cent to collect and that giving this to the consumer for prompt payment really made the rate much better to the consumer. In some towns, after ten days, a notice was sent to the consumer that he had lost his discount and unless he paid by the twentieth of the month his service would be discontinued. As a rule there was no more trouble from that customer. Ten per cent was said to be a good discount. If a company had decided to make a reduction in rates it might be a good idea to charge the old rate and give a discount to bring the bill down to the lower rate.

Regarding guarantees and deposits, much difference of opinion was expressed, some requiring a deposit from all consumers, while others required a guarantee from the owner of the property where the current was used. Those who required cash deposits paid interest on them. By this practice it was believed that the losses this year would not be one-half of one per cent for non-payment of bills. One company has all its customers make a deposit; if the customer is still on the books after eighteen months and has made prompt payments, his deposit is returned with a check for five per cent interest. The general opinion was that the companies should be liberal with the customers and try them a month anyway. The service of electric lighting is not like a grocery business, where, if the customer could not get what he wanted at one store, he had more that he could go to; electric lighting was in the nature of a monopoly, and therefore the companies should be liberal with their consumers.

It was moved and carried that a committee of five members be appointed to devise a basis of charging for electric service, and report at the next annual meeting.

WEDNESDAY AFTERNOON SESSION.

The afternoon session was held in the Elks Club auditorium, as the City Council room was found to be too noisy. H. W. Dickermann, of Rockford, read his paper on "The Relation of the Electric Vehicle to the Central Station."

This paper gave a history of Mr. Dickermann's attempts to introduce the electric vehicle into various cities and the results achieved. At first the lighting companies had not taken favorably to them and had discouraged the use of them. But later they had seen the possibilities in this service and now were more favorable to its extension. Kansas City was now a good city for electric vehicles and even with its hills one could there cover from fifty to eighty miles on one charge. There are about 20,000 electric vehicles in use in this country and 5,000 more would be manufactured this year.

F. H. Golding, of Rockford, said that his city was level and had about 140 cars that yielded an average income of $60 each per year. Fifty-seven private charging plants averaged $48 per car per year. There were six public garages. The bulk of the charging is done from 11 p. m. to 2 a. m. The charges were six cents per kilowatt-hour for private garages and four cents for public garages, with a resale of six cents to the public. This was made under contract to be an off-peak load. The average life of the battery was three years, and the cost of batteries runs from $125 to $175.

The question as to the lighting company taking care of cars was brought up and thoroughly discussed. Some thought it a good thing to do, while others thought it should be left to the public garage. The trouble heretofore has been that the public garages have not had the men who understood the care of the batteries and motors.

The Commonwealth Edison Company, of Chicago, has about eighteen 3,000-pound wagons or trucks that it uses itself and finds that for long hauls they are better than horses, while in the congested downtown districts they cannot make better time than the horse trucks. According to the state licenses issued, there are 2,300 electric pleasure vehicles in Chicago. There are over 80,000 horses in Chicago, and the average cost to feed them is $125 per year. This shows the immense possibilities of the business that might come to the lighting company. It has been said by F. M. Tait, of the Dayton Lighting Company, that the income from electric vehicles is better than that from furnishing current to a street railway.

The discussion showed that the business of charging the cars was very desirable, especially if it was an off-peak load. From the nature of it, it comes after the peak of the lighting load, and hence should be taken at an attractive figure. One company reported an income of $8,000 per year from that source, from 139 cars. If the regular rate was eleven cents, a charging rate of seven cents could be made if cars were not charged from 4 to 8 p. m.

One case was cited where the company had cared for electric vehicles and then gave over the work to the garages. This was not satisfactory, and finally the man it had doing the work took up the business again under his own name, but backed by the company. He was able to care for forty or fifty cars, and with a charge of fifty cents per week and other work he picked up, was getting an income of $120 to $175 per month.

The paper by David Davis, of Litchfield, on "Gasoline Lighting" was not read by him, as he was unable to get it ready in time on account of sickness. But he gave a talk on conditions as he had met them in his city. This caused more discussion than had been expected and showed how much the gasoline plants were doing to injure the income of central stations. The cost of the first installation of these plants did not seem to worry the consumers, who put them in on the promises of the salesman that they would not cost so much to run as his electric lights had. Few of the owners ever kept an accurate account of the cost of maintenance, and no account of the time required to care for them. At first they generally work well, but later they do not get the necessary care, then something happens. One started a fire that caused a loss of $50,000 in a double store.

Much discussion ensued on how best to overcome this competition, and several plans were suggested and ways explained how it was done by various companies. A good argument was put up by one landlord for not allowing his tenants to use gasoline for lighting, viz., that he had taken out all his stoves, installed steam heat, so to have only one fire in the building, and hence would not allow the gasoline lights to be placed in the stores. The use of the tungsten lamp with its high candlepower and low wattage was a help to the central-station men to fight the gasoline lamps. One case was cited where arcs had been displaced, the owner agreed to keep an accurate cost of his gasoline, chimneys, mantles and all renewals to his gasoline system, with the result that only twice was his total cost less than his former bill for the electric arcs, and then only $1.60 or $1.40 for the corresponding months. One company had bought several gasoline lighting plants and replaced them with electric lights. The former were then hung up in the storeroom, and whenever anyone said any-

thing about gasoline lighting plants they were offered their choice at $15 for any kind they might wish to use. This discouraged the agents and they finally gave up and left the city.

At this point C. A. Howe, of the Chicago office of the Holophane Company, gave a short talk on illumination. He gave a simple rule for finding the necessary wattage for proper illumination of various rooms. He also quoted from a letter received from an engineer showing the saving effected by the proper lighting of a factory. The modern engineer, when it came to laying out an illumination for a certain installation, too often figures out just how much he could cut down the cost of lighting. The proper thing to do was not so much to cut down the cost as to have the installation properly designed to give proper illumination with a minimum cost.

On Wednesday evening the members were the guests of the salesmen at the Temple Theatre, where they heard Damrosch's Orchestra render an excellent concert.

THURSDAY SESSION.

The first business at the session on Thursday morning was the appointment of the nominating committee, President Sinsabaugh selecting Messrs. Learned, Bivins and Brown for this purpose. The president also announced the committee that was ordered on the previous day to devise a method of making base rates for figuring the selling price of electric current and to report at the next annual meeting, the following being named: Messrs. Burton, Wallace, Cushing, Brown and Frey.

The committee on resolutions reported resolutions on the loss of Mr. Schroeder, who had died during the year. Also a resolution expressing the thanks of the association for the courtesies extended by the mayor of Alton, the Alton, Granite & St. Louis Traction Company for the trip to East St. Louis, the Illinois Glass Works for allowing the visitors to inspect its plant, the Elks Club for the smoker and the use of the lodge rooms for holding the meetings, the salesmen for the entertainment provided for the members, and the Alton Gas and Electric Company for the banquet.

The paper on "Power," by F. H. Golding, of Rockford, was then read.

In this paper Mr. Golding showed that by careful selection of the power business a decidedly improved station load factor may be obtained. The most important features to consider are hours of usage, load factor and capacity demand of each prospective installation. A consumer whose business can be regulated to suit an "off-peak" schedule and a twenty-four-hour consumer with a fair load factor are much more desirable than the short-hour consumer, and should therefore be entitled to a lower rate. Maximum demand meters are very desirable in determining the capacity demanded by the installations. If these meters should prove too costly for the size of the installations, good results may be obtained by basing the capacity demand upon the transformer capacity or the size of the fuses or circuit-breakers. The power rates should embody a suitable readiness-to-serve charge per kilowatt of maximum demand plus the meter rate for the current consumed. In planning a systematic power campaign, it is necessary to obtain complete and accurate data on each plant that is considered as a prospect. The solicitor must base his proposal to the manufacturer upon an accurate report of the conditions to be met with. It is well to train the lighting solicitors to handle power business also, since the solicitor confined to power business alone is apt to become discouraged on account of the frequent rebuffs and difficulties to be met with in this line of work. It is surprising how much power business can be built up among the smaller consumers who frequently are lost sight of in the effort to get large users of central-station power.

This started a lively discussion that a number of the members took part in. The main thing that was desired seemed to be a basis of figuring power rates. A customer that was charged a rate based on the connected load did not secure a fair rate if he had a motor that was underloaded; a betteer way was to take the maximum demand. The discussion brought out that the Ontario Power Company sells power from its plant at Niagara Falls on the basis of the average of three five-minute maximums taken any time during the month. The graphic recording meter was mentioned as the best way of getting these maximum demands, but was objected to on account of its cost. It could be used, however, to find the average demand as well as the maximum demand. Mr. Baker told of a German instrument that was operated by clockwork and could be set to take a record of the current used at any certain time and for any period of time. There are none of the instruments in this country, but he had some ordered, and thought they would cost somewhere near $30, as compared to the printing instrument at $125.

As the manufacturer always wished to know what it would cost for power to operate his factory, several methods of determining this were described, one being to install motors, if the manufacturer would pay for the wiring and keep accurate records of the power used for, say, two months. This has a double advantage, as by this method the central station and the consumer are both enabled to know just what the latter was using and the company could then make an intelligent rate for the power. It was also stated that the average factory owner always overestimated the power he was using. Often the power used could be cut down by eliminating shafting, cases being cited where the shafting and transmission were taking from twenty to fifty per cent of the power furnished. One case was cited where the factory owner was using a thirty-five-horsepower steam engine that was displaced with a ten-horsepower motor, with satisfactory results.

The matter of pumping water was discussed, and it was said to be good business, especially on account of the moral effect, for the lighting plant doing this work. As to the size of the motor that could be put upon a generator without spoiling the regulation or causing the lights to flicker, there was shown to be diversity of opinion; one plant with a seventy-five-kilowatt generator was running a forty-horsepower single-phase motor, with a separate transmission line, but this was doing a twenty-four-hour service, with a steady load pumping water. Regarding the cost of pumping water, a case was told of where against a 100-foot head with a triplex pump 700 watt-hours per 1,000 gallons was taken.

The last paper on the programme, entitled "The Advantages of the Tungsten Lamp," was then read by its author, J. G. Learned, of Chicago.

In Mr. Learned's paper the well-known advantages of the tungsten lamp in affording more and better light are clearly shown. It was feared by many central stations that on account of the high efficiency of this lamp, and therefore the possibility of furnishing the same amount of light with much less current, it would hurt the revenues of the companies quite materially. This fear has proven to be unfounded. The advantages of the lamp have been shown to apply mutually to the customer and the central station. By means of this lamp the central station has been enabled to secure a very large volume of new lighting business. The slight reduction in the revenue secured from some lighting customers, who have installed tungsten lamps to secure reduced bills, is more than made up by the large number of new customers, who are attracted to central-station service on account of the great economy of this lamp. Tungsten lamps will continue to be improved, as they have been very materially since their introduction. Their cost will doubtless be decreased and their life or efficiency further increased.

The main thing brought forth in the discussion was not the reducing of the customer's bill so much as the giving of better service and more light for the same money; also the fact that the cus-

tomer is better satisfied with the installation, and that the best is none too good. It was stated that if the lamp held up for three days it was an evidence that it would burn the full allotted life. One company reported that with the use of the tungsten lamp it had decreased its peak load, but had also broadened it out. Special attention was paid to the securing of window lighting with the tungsten lamp, as the greatest advantages came with the longer burning lights. A case was related where the lighting company designed the lighting equipment and selected the size of the lamps to be used; then, as it did no wiring nor furnished fixtures, it made the specifications so that each contractor could have a set and submit to the owner a bid on the installation. This made a good basis for comparing the bids and the customer reaped the benefit of the equipment installed at the best obtainable price, with the advantage of the illuminating engineering furnished by the company.

This closed the session, and after a recess of five minutes the convention went into executive session and elected the following-named gentlemen for officers for the ensuing year:

President, E. W. Smith, manager of the Kewanee Light and Power Company, of Kewanee, Ill.

First vice-president, W. G. Austin, of Effingham.

Second vice-president, H. A. Foster, of Fairbury.

Third vice-president, J. J. Frey, of Hillsboro.

Fourth vice-president, F. H. Golding, of Rockford.

Treasurer, E. MacDonald, of Lincoln.

Secretary, H. E. Chubbuck, of La Salle.

Assistant secretary, C. A. Willoughby.

Executive committee: W. B. McKinley, F. J. Baker, E. S. Schmidt, F. M. Sinsabaugh and David Davis.

In the afternoon of the last day a trip over the Alton, Granite City & St. Louis Railway to its power house at East St. Louis was taken advantage of by those in attendance, with the compliments of the railway company.

On Thursday evening a banquet was given at the Illini Hotel to the delegates and salesmen who remained, as the guests of the Alton Gas and Electric Company, which concluded the programme.

EXHIBITS.

A new departure was made in this convention, as the various manufacturers and supply houses had exhibits in the basement of the Illini Hotel, which was headquarters for the convention. The various companies made interesting displays of their goods and the local lighting company ran in a special heavy service. There was evidence everywhere that the tungsten lamps were much in use, as these were shown from the small sign lamp to the largest made.

The H. W. Johns-Manville Company showed its new tungsten Linolite and also carbon lamps, No-ark fuses, services boxes for all classes of work, high-tension fused disconnecting switches, mica insulators of all kinds, guy anchors, weatherproof mica sockets and heating pads. H. M. Frantz, of Chicago, was in charge, with W. E. Rapp, of St. Louis, to assist him.

The Electric Appliance Company, of Chicago, together with the Sangamo Electric Company, of Springfield, made an interesting working exhibit of Sangamo meters, regenerative flaming arc lamps, electric heating goods of the American Electrical Heater Company and small sign lamps on the transformer system for tungsten lamps. H. N. Remington, F. W. Greusel, R. C. Lamphere and J. H. Hodde were present

The Westinghouse Electric and Manufacturing Company had an exhibit that showed electric heating and cooking goods, electrically operated sewing machines and washing machines, the small five-watt sign lamp and electrical testing instruments. W. R. Pinckard, J. M. Schilling, Jos. W. Busch, R. W. Emerson, F. A. Servis and C. R. Wood, of the Chicago office, were there with the force from St. Louis, consisting of W. S. Wiswall, and Messrs. Bussman and Jackman.

The Electric Service Supplies Company had an exhibit, consisting of the specialties that it handles, with several representatives from Chicago in charge.

The Century Electric Company, of St. Louis, had a display of single-phase motors.

The Jandus Company had an exhibit of its fans and lamps, which was in charge of W. L. Cummiskey, of St. Louis.

The Holophane Company was represented by C. A. Howe, of the Chicago office, who had a display of the Holophane goods from the smallest Holophane glass to the largest made, and also the new D'Olier steel factory reflectors.

The Condit Company, with Wm. S. Taussig, of Chicago, showed a line of switches, circuit-breakers and other specialties.

The Wagner Electric Manufacturing Company, of St. Louis, exhibited its single-phase motors and lamp-testing volt and wattmeters. F. Johnson, of St. Louis, was in charge.

The Pacific Electric Heating Company had a number of its irons, together with other electric heating goods, on display. H. F. Holland, of the Chicago office, was in charge.

The Tungstolier Company had its booth filled with the fixtures it is making and especially called attention to the new cloister finish that is now proving so popular with the public where serviceable finish is desired. A. B. Wilson, Illinois representative, was in charge.

The Keller Manufacturing Company's Santo vacuum cleaner was shown and attracted much attention from the station men as another source of income for them.

The Fort Wayne Electric Works showed meters, small motors, transformers, and the special transformer for picture machines that makes a material saving in the cost of operation. L. A. Carr, A. L. Pond, and Mr. Weymeyer were on hand.

The Central Electric Company, of Chicago, made a complete display of its well-known specialties, such as Okonite wire and tapes, Columbia tungsten lamps, D & W specialties and Pittsburg transformers. One of the newer specialties which attracted much attention was the P-M meter testing system, which comprises a complete method of installation, test and inspection. The new type of Opalux shades and reflectors were effectively displayed by the decorative outline scheme of the booth. As usual, a complete display was made of the Pittsburg silico-vanadium steel, high-efficiency type transformers of various capacities. Other features were high-tension disconnecting switches for indoor and outdoor mounting, high-tension wall tubes for carrying transmission wires into stations and a new design of three-phase 12,000-volt cable pot head. A unique measuring instrument known as the "tungstometer" was connected in service and indicated the wattage consumption of Columbia lamps. The exhibit of Okonite insulated cables, wire, etc., for all classes of service and crude rubber in the form received from the natives by the rubber-producing companies was instructive. The enormous biscuit of Up River para rubber excited much comment. Particular attention was called to the long life of Okonite insulation, which is due principally to the use of thirty per cent of Up River para rubber in the insulating compound. The company was represented by H. W. Young, sales manager; Louis Privat, of the Southern Illinois district, and J. M. Lorenz.

The Wesco Electric Supply Company, of St. Louis, had an exhibit showing Holophane shades, electric chafing-dishes, coffee percolators and electric irons.

The General Electric Company did not make an exhibit of goods, but had a space where Mr. Croniger, J. F. Kidd, V. A. Hain, J. A. Van Splunter and J. S. Buchanan offered one a seat and explained how the company was able to take care of all one's electrical wants.

The Illinois Electrical Exhibitors' Association.

The Illinois Electrical Exhibitors' Association, having as its membership the representatives of various electrical manufacturing companies, formed a permanent organization during the recent convention of the Illinois State Electric Association.

This new association will co-operate with the state organization in the matter of conventions and exhibits for the same, and will undoubtedly tend to strengthen the latter organization.

The first president elected by the new association is W. R. Pinckard, of the Chicago office of the Westinghouse Electric and Manufacturing Company, and the first secretary is William S. Taussig, who is now also secretary of the Chicago Electric Club.

Receivers for Electric Road.

Judge Barnard, of the Supreme Court of the District of Columbia, has appointed George T. Bishop, of Cleveland, Ohio, and George Weems Williams, of Baltimore, auxiliary receivers for the Washington, Baltimore & Annapolis Electric Railway Company. The receivership proceedings were not resisted by the company.

THE AMERICAN ELECTROCHEMICAL SOCIETY.

SIXTEENTH GENERAL MEETING, NEW YORK CITY, OCTOBER 28, 29 AND 30, 1909.

The sixteenth general meeting of the American Electrochemical Society was held in New York city on October 28, 29 and 30 last.

The Thursday afternoon (October 28) session was called to order by President L. H. Baekeland, of Yonkers, N. Y., at the Chemists' Club, 108 West Fifty-fifth Street, at two o'clock.

The first paper was read by William S. Weedon. A short abstract of the paper follows:

THE TITANIUM ARC.

The author began by stating that as a result of a series of experiments made some years ago to determine what material would give the maximum light efficiency when used as arc electrodes, none of the substances tried was equal to material containing the element titanium. Titanium carbides, being the most convenient preparations of titanium available, were tried in various forms, and it was found that a mixture of TiC and Ti gave the best results, especially when iron was present only in negligible quantities, as this latter metal tended to cause unsteadiness of the arc. The best arc was obtained by using a cathode electrode of titanium-carbide preparation, and an anode electrode of copper, the latter being inactive and not wasting appreciably. The deposition of a titanium oxide "button" on the copper anode can be obviated by the use of Halverson's anode "rocker" (designed originally for the magnetite lamp), which is connected to the lamp mechanism, so that the arc plays upon one portion of the anode while running, but strikes from another portion. It was explained that the titanium arc is a flame arc, and that the efficiency increases with the current density and the arc length. Volt-ampere curves and volt-arc-length curves were given, also the power-consumption curves, the last showing the titanium arc to be extremely efficient. The efficiency curves proved that titanium-carbide arcs are most satisfactorily operated on a constant-current circuit rather than on a low-voltage multiple circuit (with the necessarily short arc length). Photographs of plain carbon and various flame arcs were given, with accompanying observations, for purposes of comparison. A diagram of the light distribution of the titanium arc showed the superiority of this type of arc for street-lighting purposes. A short account of the method of preparation of titanium carbide electrodes, and a résumé of some experiments carried out in the research laboratory of the General Electric Company on the titanium suboxide direct-current arc, concluded the paper.

The president, in calling upon Doctor Whitney to open the discussion, characterized the paper as the result of several years of conscientious and very intelligent work. The society, he said, was to be congratulated on having the opportunity of listening to a paper of this sort.

Doctor Whitney, of the General Electric Company, said that most of this work by Doctor Weedon was the result of original experimentation in the use of titanium lamps, and he arose, not to discuss the subject-matter presented in the paper, but to apologize for the delay in the publication of the experiments. The General Electric Company would like to be able to publish rapidly and immediately the results of experiments in its laboratory, and similar researches, but the commercial conditions do not always permit this to be done. One interesting thing that always appealed to him in Doctor Weedon's data was the efficiency obtained in the socket. One way of determining luminous efficiency is to put a lamp in a vessel of water and determine the rate at which it heats the water. The rate at which the lamp heats the water gives the data for determining the lamp efficiency. That was determined by Tumlirz and his 100 per cent efficiency is 0.22 of a watt mean spherical candlepower, which Doctor Weedon has found almost met by this titanium arc, 0.37 of a watt. In other words, apparently, from this data, we are getting down to the percentage of efficiency for light. The probability is there is an error in the Tumlirz measurements and those made by Aengstrom; in other words, 0.11 of a watt per mean spherical candlepower, which is 100 per cent light efficiency. That is also probably wrong. The interesting question might come up as to how near we are to the theoretically perfect light. He opined in that connection that we still have about as far to go as we have gone.

Dr. S. A. Tucker, of Columbia University, said that he has tried a good many different compounds to make carbide, and has made them up into electrodes and tested them with a photometer. His experience was that the zirconium carbide was more efficient than the titanium carbide. He asked for information on this point.

Doctor Weedon said that he had tried the zirconium carbide obtainable at that time, and it was not as efficient as the titanium carbide.

Prof. J. W. Richards, of Lehigh University, asked Doctor Weedon whether they had tried the carbides of aluminum, magnesium, beryllium, cerium, lanthanium, didymium, zirconium and thorium, or mixtures of the same, as to whether they might explain the great luminosity of this arc. His friend, Porter W. Shimer, of Easton, had shown him some specimens of a residue, in perfect crystals, obtained by dissolving titanium in pig iron. Mr. Shimer had taken and analyzed them, and found them to be titanium carbide, having the proper formula, and came to the conclusion that titanium, as dissolved in pig iron, was there as titanium carbide, and not as simply fused or generally dissolved titanium. That may have some bearing on the properties of titanium salts.

Doctor Weedon said they had tried practically all of these rare metal carbides and were not able to obtain any which had greater efficiency than the titanium carbide, but he thought it should also be stated that a great deal depends on the direction of current used.

Doctor Whitney suggested that the use of these metals is out of the question in arc lamps until we have some way of preventing the consumption of the electrode. The electrode will burn from 100 hours to 200 hours, and most of the metals which have been mentioned are too expensive to be practically used in electrodes which will burn for comparatively so limited a time.

The next paper was by E. Weintraub, on "The Element Boron," which was read and discussed.

The paper entitled "The Preparation of Silundum," by Prof. S. A. Tucker, H. F. Kudlich and E. M. Heumann, was read by Professor Tucker. Samples of silundum were handed round for examination during the reading of the paper, an abstract of which follows:

THE PREPARATION OF SILUNDUM.

Silundum is defined as a preparation made by partially converting carbon into carborundum in the electric furnace. F. Bölling, the discoverer of silundum, first produced this substance by heating carbon in an atmosphere of silicon, the combination of the two producing carborundum, which is absorbed by the carbon to a depth varying with the temperature and the time of the reaction. The present paper is an account of an experimental study of the formation of silundum. The charge was first made up according to the reaction used by F. J. Tone ($SiO_2 + 2SiC = 3Si + 2CO$), and placed in a fire-brick furnace similar to that used in making carborundum, but using a core made by pressing together a number of small carbon plates between two horizontal graphite electrodes. Around the core was placed a charge of sand and carborundum, in which was embedded at various distances from the core the carbon articles to be converted into silundum. Air was excluded by concreting the side and end walls of the furnace. Several experimental runs, at different currents and voltages and under various conditions, were made, and the results noted. In run No. 8, in which the most satisfactory results were obtained, no cover was built over the furnace, the gases being allowed to escape and burn over the entire surface, as in a carborundum furnace. The penetration or conversion of carbon into silundum de-

pends upon the time of the run and also on the temperature employed. The conversion of the carbon into silundum depends upon its position with respect to the core. No very careful study was made of the product; the following points were noted, however. In appearance it is compact, of a light gray to greenish color. It has a hardness apparently the same as carborundum and is heavy. Its most valuable property and probable use is its ability to stand a high temperature in the air without sensibly undergoing oxidation, and, as it is a conductor of electricity, its use as a resistor material. Several experiments were made with a view to testing it in this capacity, and they pointed to a satisfactory material for temperatures up to say 1500 degrees centigrade. The electrical resistance of the material varies greatly, depending upon the penetration, but there seems to be no reason why the material should not prove valuable as a resistor material and come into general use for a variety of purposes in which a high temperature is to be maintained electrically.

Professor Richards said that the reaction recalled to his mind what he had conceived as a method of the preparation of carborundum. He had studied the carborundum furnace a good deal, and seen it in operation, and always thought that the large crystals were produced by contact of the silicon vapor and the carbon vapor. He could not conceive of the production of these crystals in place, except from the interaction of two vapors, one of silicon and one of carbon. Here is a case, he said, where we have the proof, in the electric furnace, of the presence of a large amount of silicon vapor, and further suggested that at the proper temperature, in contact with carbon vapor, this vapor causes the formation of the crystals of carborundum.

Doctor Whitney wished to differ with the definition given by Doctor Tucker. He imagined that silundum is a compound or mixture of some metals. Is it a mixture of carborundum, he asked?

Professor Tucker said that as far as he could see, there is a penetration of the silicon vapors into the massive carbon. This penetration depends upon the temperature, and the length of time it is exposed to the effect. The converted material on the outside is what Bölling calls silundum. As to what the chemical composition of that is, he did not knew, because he had not analyzed it, nor did he think anyone else had. It has a good many properties of a very similar nature to carborundum.

C. A. Hansen, of the General Electric Company, said his company had a small grid, similar to one Bölling gives a picture of, one inch long by one-eighth inch in diameter. He had analyzed some of these, and they were eighty-two per cent silicon. They have a grayish green on the surface and the centers were dark, in appearance something like magnetite, brown metal, or metal oxide. He would like to agree with Doctor Tucker as to the lasting properties of this grid. He ran it for two days at 1,300 or 1,400 degrees, and it then broke mechanically.

Doctor Tucker, answering a question by M. H. Kohn, said the resistance of silundum is greater than that of the original carbon, but every piece of the material he obtained seemed to have its own resistance depending on the penetration of the silicon vapor, and as far as he could find out, those which were completely converted through and through, were practically non-conducting.

C. A. Hansen said he had twenty pieces, one inch long and one-eighth inch in diameter, and they seemed to be fused together with silicon at the points. That grid took something like 1.2 amperes at sixty volts, and when heated up to 1,400 degrees, it would stand the pressure. The little grid took something like four amperes at twenty-five volts.

F. J. Tone, of Niagara Falls, said he had analyzed many samples of silundum made in accordance with the processes described, and in every case found that silundum consists principally of carborundum. The percentage of carborundum will vary from 96.0 to 93.5 per cent. There is often present a small percentage of metallic silicon, but for all intents and purposes, the material is silicon carbide. He did not agree with Professor Tucker that pure silundum is a non-conductor. It has a high resistance when cold, but it has a large factor of conductivity, and this is increased very rapidly by rise in temperature. Professor Tucker also states that the penetration depends on the time of the run and the temperature employed. He thought another consideration which governs this is the character of the atmosphere.

The president then announced the presence of Prof. H. E. Armstrong, a distinguished chemist of London, Eng., who he hoped would subsequently address the meeting. He then called on Prof. Edgar F. Smith, of Philadelphia, whom he congratulated on his recovery from a recent severe illness, to address the meeting. Professor Smith, who was received with a burst of loud applause, then took the floor. An abstract of his address follows:

PROFESSOR SMITH'S ADDRESS.

Thirty-one years ago, while teaching quantitative analysis to boys, I became disgusted with the methods then in use for the determination of copper. You are familiar with them as they are laid down in our text-books, and you all know from experience the difficulties which surround them, and so I was led to try the suggestion of our dear Doctor Gibbs, no longer with us, namely, to let an electric current act upon the salt of copper that was up for analysis and obtain the metal. I arranged two bichromate cells, and connected with one pole a platinum spiral. That was my anode. It dipped into a solution of copper sulphate contained in a small platinum crucible, around which crucible was wrapped a bit of copper wire, which was my cathode, and I watched that brisk current—that is the thing, the energetic current—and I soon saw the copper make its appearance upon the inside of the crucible. Cadmium seemed to be a good deal of annoyance to us in those days, particularly when we undertook to separate copper from cadmium, and the question came to my mind, May not cadmium be determined in the same manner as copper? And so we substituted a solution of cadmium salt for the copper salt, and the same little process was tried, using, however, not the sulphate of cadmium, but the acetate, and there appeared on the sides of the cathode genuine, crystalline cadmium, the first time it was ever determined in an electrolytic way, and determined with extreme accuracy. Its separation, however, was still bothersome, and that was realized in a day or two afterward, when from a nitric acid solution containing the two metals copper was deposited free from cadmium. I continued practicing the electrolytic method for the determination of metals, and went on to uranium, and was made happy when that great analyst, Freder Ghent, professor of chemistry in our institute, said to me: "One of the difficult problems in analytical chemistry is the satisfactory separation of uranium from alkalines." I said nothing in reply to what the professor said, but concluded I would see what the electric current would do with a solution of some uranium salt, using the double acetate of potassium, and applying the same current from the two bichromate cells, capacity unknown, not measuring the strength of the current at all, but just proceeding in that simple way. Uranium was deposited as the hydrate-sesquioxide existing in hydrate form in the cathode, and it was not long until I was able to tell the doctor that I could determine uranium electrolytically, and that I could separate it from potassium. So he wanted to see this separation of uranium from the alkaline metal. He saw it, and then he turned over to me a solution, without telling me anything about the quantity of metal with which he started, giving me no idea as to the content of uranium, or sodium, or potassium, and he said: "Electrolyze that." It was done, and my happiness was increased when he told me, after I had repeated the separation three or four times, that my results agreed most accurately with his, both for the uranium and for the sodium, and there was a separation which was done in an hour's time, a separation which, by the old method which he pursued, required hours, really days. Tungsten has always been a favorite element with me, in conjunction with molybdenum, particularly having in mind the separation of the two metals. In the course of our early experimentation we learned that it was possible to deposit molybdenum from a hydrate upon the cathode, as a hydrate of sesquioxide. Taking a normal tungstate and exposing it to the same current conditions, so that there was no deposition of tungsten, so that there was a mixture of these two, acted upon by our current, would probably give us the desired separation. The metal in-

variably contained tungsten, and then on watching this deposition of molybdenum, we saw blue threads passing out from the cathode toward the anode, little blue threads, and as they approached the anode they vanished. The idea then came to mind that if possible the electrolyte, was agitated, these blue threads, which were one of the oxides of tungsten, would not appear at all, there would be no reduction of tungsten, perhaps, it would not eliminate the molybdenum, so the agitation of the electrolyte suggested itself. In 1886 Von Klubukow agitated the electrolyte by rotating first the cathode and then the anode, and later holding the electrode stationary, and rotating the electrolyte. It was a new thought, this agitation of the electrolyte, and he said, after a great deal of experimentation, he thought the rotation of the anode was the best. His anode rotated 120 times in a minute, but he never published any results as the result of this rotation. In 1901, when molybdenum and tungsten separation was in mind, we hoped that agitation perhaps would enable us to effect this separation, and the thought came that with agitation you can increase the current, you can increase the pressure. We did not succeed in separating molybdenum from tungsten, but we put into vessels (which were exhibited) copper sulphate, mercurous nitrate, etc., and while rotating the anode, agitated the electrolyte; in other words, we were able by turning on a high current under great pressure, to throw these metals out in a few minutes.

At this point in his address Professor Smith made a series of experiments along the lines previously suggested, and told in a most entertaining and exhaustive manner the latest researches in electrolytic analyses.

At the conclusion of Professor Smith's address, the president said: "Gentlemen, in expressing the thanks of the society to Professor Smith, my only regret is that my eloquence will fall very far short of my enthusiasm. Professor Smith has shown us that from a subject that to many of us appears merely as one of the many varieties of analytical drudgery can be developed to one of inspiration."

Prof. Henry E. Armstrong, of London, England, then addressed the meeting as follows: "I count myself very happy in having accidentally come here to-day and had the opportunity of listening to the charming account given by Professor Smith of his remarkable work. Of course, every chemist has become acquainted with Professor Smith's work, but, after all, the ideas we get when we read about these things are very feeble, indeed, in comparison with the impressions we get when we come face to face with the man and have some opportunity of judging of the way in which he looks at his work. Professor Smith may or may not be a physical chemist, but it is quite clear that he is a very human person, with a peculiarly characteristic personal equation, and we have the opportunity of realizing something of the value of that equation, and we can very easily see what an influence such a man must exercise upon his students."

EXCURSIONS AND ENTERTAINMENTS.

The whole of Friday was devoted to excursions and entertainments. A special train from Jersey City at 8:30 a. m. took a large party of members and guests to the Constable Hook section in Bayonne, N. J., where the forenoon was spent. In the afternoon plants in the Newark Bay section of Bayonne were visited. At noon a lunch was served at a shore resort on the Kill von Kull.

The following plants gave permission to visit their plants, excepting to those interested in rival industrial processes: Standard Oil Company, oil refineries; National Sulphur Company, refining of sulphur; Pacific Coast Borax Company, manufacturers of borax and boric acid; Gröndal briquetting plant at the works of the General Chemical Company, the first American installation of the Gröndal process; Babcock & Wilcox Company, water-tube boilers and adjuncts; Electro-Dynamic Company, interpole motors for wide speed-variation; Electric Launch Company, submarine vessels, etc.; Industrial Oxygen Company, oxy-acetylene welding and cutting apparatus.

At 3:30 p. m. an automobile excursion around New York, starting from the Hotel Cumberland, was provided for the ladies, and at 7:30 p. m. a subscription dinner, at $2 a plate, was served to a large company at the same hotel.

Other entertainment features were provided on Saturday, including a luncheon for members and guests, including ladies, at the Columbia University Dining Hall. A smoker at the Assembly Room of the Chemists' Club was also well attended and much enjoyed.

SATURDAY MORNING SESSION.

The Saturday sessions were held in Earl Hall, Columbia University. President Baekeland called the morning session to order at 10 a. m.

The first number on the programme was a paper by R. C. Palmer, entitled "A New Electrolytic Method for the Preparation of Explosive Antimony." This was read by Professor Richards in the absence of the author, and was passed without discussion.

Another paper read by Professor Richards was one by Frank C. Mathers, on "The Influence of Perchloric Acid on Electrodeposition of Metals." This, it was explained, was preliminary to a fuller paper to be presented by the author after further experimentation. The paper was discussed briefly by Professor Carhart.

The next paper, entitled "The Laws of Electrode Losses in Electric Furnaces," was presented by the author, Carl Hering.

LAWS OF ELECTRODE LOSSES IN ELECTRIC FURNACES.

In a previous paper the author had shown how it is possible to obtain in practice the combined effects of perfect heat insulation and good electrical conductivity. He pointed out that electrodes of electric furnaces, which possess, as they should, the property of being good electrical conductors, necessarily also have the accompanying objectionable property of being good heat conductors. Hence, a way in which furnace electrodes of good electrical conductors may be made to also act as good heat insulators is of interest and importance to furnace designers. Based on this method, the author has developed the laws according to which electrodes should be designed in order to reduce the loss of power and the amount of electrode material to the least possible. The purpose of the present paper is to enunciate these laws, illustrate their application and show their derivation. The results are in some respects quite different from what has generally been supposed, hence, economies, which sometimes may be quite great, will become possible in many if not in most cases. An extended abstract of this paper will be given in an early issue of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN.

The discussion was opened by a communication from Dr. A. E. Kennelly, read by the secretary. The rest of the discussion referred mainly to the illustrations and to a previous discussion at a former meeting of the society.

The paper, "Furnace Electrode Losses," was then read by the author, C. A. Hansen.

FURNACE ELECTRODE LOSSES.

This paper was professedly only an attempt to analyze the electrode losses in a particular furnace under observation, and to supply such data concerning "constants" as is derivable from the work done in this connection. This furnace has been so charged at different times that it would finish its run at 10,000, 15,000 and 20,000 amperes, respectively, being kept at these current values for several consecutive hours in each case. The losses as determined in the cooling water under these conditions remain fairly constant, showing that in all probability an equilibrium has been established within the electrode. The temperature at the hot electrode end was found in each case to be about 3200 degrees centigrade. The cold end of the electrode reached a temperature of approximately 200 degrees centigrade. The temperature difference was therefore 3000 degrees centigrade. The author proceeded to analyze the losses to see what can affect them and how far they are determinable from published data. These were considered under the following heads: (1) Joulean heat; (2) heat conductivity; (3) contact resistance (so far neglected in formulas hitherto published). The several divisions were considered in detail at some length. A table of resistances of Acheson graphite elec-

trodes was then given, as were also similar tables relating to National Carbon Company's electrodes. A diagram showing resistance of an electrode made by the National Carbon Company was adduced to show where the speculation as to the temperature resistance for carbon comes in. The effective lengths of electrode and contact resistance were considered together, the discussion thereon being illustrated by reference to test results of a recent run. A consideration of the electrical resistance of graphite, of heat conductivity, and a method of calculating the losses for titanium-carbide furnace electrodes, concluded the paper.

Carl Hering, opening the discussion, pointed out that some of Mr. Hansen's curves and figures for carbon might cause a misunderstanding, inasmuch as they referred to carbon which had become more or less graphitized and therefore did not gibe with the speaker's curves (also used in the paper under discussion) for carbon which was not graphitized. While characterizing the paper as a very valuable one, Doctor Hering did not agree with the author in some of his deductions. He proceeded to point his remarks at length by reference to the figures and formulas in the paper.

F. A. Lidbury, of Niagara Falls, N. Y., also contributed to the discussion, which was closed by Mr. Hansen.

The next paper was entitled "Electrode Losses and Furnace Efficiency," by E. F. Roeber. Mr. Roeber expressed his regret that his paper had not been printed, and then delivered a description under the heading of the subject of his paper.

The paper entitled "A New Method of Measuring Mean Thermal and Electrical Conductivities of Electrodes," was then presented by Carl Hering.

A NEW METHOD OF MEASURING MEAN THERMAL AND ELECTRICAL CONDUCTIVITIES OF FURNACE ELECTRODES.

The object of the present paper is to suggest a new method applicable to electrical conductors as distinguished from the refractory heat insulators, and intended chiefly for the materials used for electrodes. It has the advantage of simplicity and it is believed to be accurate, as there seem to be no sources of relatively large or uncertain errors. The basis of the method is a formula recently deduced by the writer for the relations between the temperature and the flow of heat under certain conditions. In the method of test adopted, a rod of the electrode material to be tested is embedded in a heat-insulating material, except at its ends, which are kept at a relatively low temperature, as by means of a water jacket. The heat-insulating material is assumed to be a perfect heat insulator and a method of approximating closely to this condition is given in the paper. A relatively large electric current is passed through the rod from end to end, and temperatures are measured by a thermometer or pyrometer introduced at the middle point of the rod. The temperature at the center and at the cooled ends being measured, also the current and voltage between the two terminals, the heat conductivity of the material may then easily be calculated. From the same readings of the volts and amperes in this test the mean electrical resistivity for the same range of temperature can also be ascertained. Attention was directed to a curious and interesting relation which occurred in these tests, as it bears on the voltages required in such cases. For a given temperature drop, this voltage between the two cold ends is always the same for any given material, no matter what the length or cross section of the sample is. A long or short, thin or thick rod of a given material will require the same voltage to raise it to the same temperature at its middle point, assuming, of course, that the conditions are perfect. With less than this voltage it is impossible to raise the rod to that temperature and with a greater voltage the temperature will always be higher; no changes in the dimensions of the sample will change it. The current will be different, but even it will be the same for different lengths and cross sections when their ratio is the same. The current will, of course, be less the greater the proportion of the length to the cross section. This voltage is different for different materials, and it is, therefore, quite as characteristic of the material as are the thermal conductivity and the electrical resistivity; for one degree drop in temperature it is numerically equal to 5.788 times the square root of their product. This voltage may be said to be a physical property which depends on these two properties jointly, and as it has an important bearing in the selection of the material for electrodes of electrical furnaces, the author has suggested the name "electrode voltage" for it.

The paper was discussed by Professor Richards, F. A. Lidbury and W. C. Arsem, and Doctor Hering replied to various points raised.

A paper entitled "The Practical Conductance of Electrolytes," by Joseph W. Richards and W. S. Landis, was then presented by Doctor Richards.

The paper was discussed by W. R. Whitney, T. Wolcott, M. Loeb, E. A. Sperry, Carl Hering, the President, and Prof. J. W. Richards.

A NEW THEORY FOR CORROSION.

The next subject was "A New Theory for Corrosion," by Maximilian Toch. Mr. Toch, who had no prepared paper, said in part:

The theory on which this investigation is based was really due to the experiments performed by Mr. Sperry, who in a paper before the New York Section of the American Chemical Society showed scrap steel, which had been detinned and subjected to a current of low voltage and high amperage in an alkaline solution. Such steel was immune from further corrosion. An experiment which I carried out along these lines was the electrification of sheets of steel in solution of known strength of sodium carbonate by means of currents properly measured. In every instance it was found that where the voltage was low and the amperage high, the cathode plate was protected, except where the solutions were weak, and on the side which faced the anode, and where the electricity naturally left, the corrosion would start almost immediately after taking these plates out of the solution. This process may be of commercial value for immunizing bolts, nuts, screws, etc., such as are used in bridges and all exposed structures. We know in common practice that many bolts rust and repel paint, and just as many attract paint and never corrode, so that we may in this find that the immunizing effect of those bolts which do not corrode may be due to the fact that they are cathode and remain so.

S. S. Sadtler, of Philadelphia, in opening the discussion, said he was of the opinion that one of the reasons for the corrosion of steel, especially modern steel, is the fact that it contains particles of manganese, and it is possible if that steel is made anode in a solution of carbonated soda, and a high current of great strength is passed between the plates, that the manganese may be fully oxidized and dissolved by the soda of the solution, and therefore removed from the surface of the steel, and that may account for the resistance that steel has shown to the agencies of corrosion.

Richard H. Gains, of New York, believed the whole question of corrosion depended upon the parasite to which steel properties are exposed. Some recent analyses of rust he had made for the Board of Water Supply have convinced him that part of the corrosion in the soil is at least due to bacterial activity.

Mr. Toch said he had heard of what Mr. Gaines has said about corrosion being caused by bacteria. He thought this action would probably be due to some fungi, more than bacteria, because French writers demonstrated thirty years ago that copper was corroded by means of certain fungi.

Elmer A. Sperry said he thought Mr. Toch's modest paper possessed a good deal of merit and originality. In detinning with chlorine, he found that some thirty-six per cent of the total tinning on tin plate is in the alloy zone, actually below the surface. It could be washed off with sand, at proper temperature. For anything like complete retinning, he said, we must go into the alloy zone and pull up the tin to a point of 0.4 per cent before the steelmakers will accept it. That naturally leaves a very spongy surface of the iron, and whereas, at certain high temperatures, in the presence of chlorine, nearly all of the iron will go into the iron-chlorine contents, yet no matter how well you carry that reaction out, the surface seems still to have this same bacteria upon it that Mr. Toch refers to. It contains little unseen particles of ferric chloride which are extremely microscopical, and after the scrap has been put out in the yard, waiting for the rise in price

of steel scrap, we find we have not steel any more, but a scrap heap which consists of iron, because of the perverse action of this film, that can hardly be observed, of particles of ferric chloride. He was trying to reduce these particles, and found that no amount of washing in hot alkali, where there was a perfectly free alkali, would remove the trouble. The idea occurred to him of taking a cathode and putting a good heavy current through it, and in that way hydrogenizing the surface, as it were, and reducing this ferric chloride. He got rid at once of the acid that destroyed the steel. In one case he took two billets, five by thirteen by thirteen, one of them treated in this way, and one not treated in this way, and the one which was not treated dissolved into a little heap of iron work, and the other stood up and retained its size and shape. A piece of steel the surface of which was treated to a depth of one-eighth of an inch would be found to have retained its original elasticity. It would bend many times before breaking, whereas a piece of steel not so treated would break every time it was bent. That was the work which Mr. Toch referred to in his remarks.

SATURDAY AFTERNOON SESSION.

President Baekeland called the afternoon session to order at 2:30 o'clock. The first paper on the programme was "Evolution and Present Status of the Dry Cell," by Dr. J. W. Brown. Doctor Brown was not present, and the next paper, entitled "Dry Cell Tests," was then read by F. H. Loveridge. This paper gave rise to considerable discussion. Dr. Carl Hering proposed that a committee be appointed to formulate rules for testing dry cells, etc. This question was eventually referred to the Board of Directors.

The paper entitled "Some Characteristics of Dry Cells," by Dr. C. F. Burgess and Carl Hambeuchen, was then read by the former gentleman.

CHARACTERISTICS OF DRY CELLS.

Most of the uses of dry cells involve relatively low rates of energy delivery. Low resistance is an important qualification for dry cells, except, perhaps, where only small quantities of energy at low voltage are required. "Minimum polarization" and "rapid recovery" are other factors to which attention is called by manufacturers in advertising their dry cells. It is impossible to point out which is the most important of these qualities, since the relative importance depends upon the character of service required. Among the minor characteristics which are sought to be attained in dry-cell construction are: Absence of the leakage of the liquid, minimum increase of resistance with low temperature, convenience for connecting into circuit, and the general appearance of the cell. The factors which govern the above characteristics include these: Materials employed in construction, the proportions of materials, the chemical and physical qualities of these materials, methods of assembling. General instructions and common practices for dry-cell construction were given by the authors, who stated that the quantity of water to be added to the electrolyte depends upon the dryness of the original materials, the fineness and quality of the paper lining, etc. Starch and other forms of paste are frequently added to improve contact of electrolyte to zinc and promote distribution of action throughout the charge. Mercury is sometimes added to amalgamate the zinc. Purity of materials is an important requisite, and porosity of the granules of manganese dioxide appears to be important. The quality of the carbon filling seems to play an important part, and the increasing use of graphite for this purpose is commendable. Purity of the sheet zinc is of great consequence as tending to reduce local action to a minimum. The presence of copper is very deleterious to a dry cell. The introduction of the filling, from whatever cause, between the zinc and the paper lining is objectionable as causing certain differences of potential tending to run down the cell. Uniformity of the mixture is also a matter of considerable importance. The voltage at the cell terminals while delivering current naturally depends upon a number of factors, the principal of which are the activity of the depolarizing material and the internal resistance of the cell. The activity of the depolarizer increases as the cell is used, and even more marked is the increase in resistance with the number of ampere-hours delivered. It is very commonly believed that the increase in resistance is due to the drying out of the cell, but the drying is of very minor importance as compared with other factors. One of these is the increase in resistance due to the partial reduction of the manganese dioxide. Another is the accumulation, on the surface between the paper and the zinc, of nonsoluble impurities of the zinc and the various basic salts and double salts resulting from the electrolytic corrosion. The presence of zinc chloride in the electrolyte markedly decreases the local action. Finally, rating of cells should be stated by energy rating, as determined by the usual standard methods for conducting tests.

This paper was discussed by Dr. Carl Hering, C. L. Parsons, J. A. Seede and S. P. Sharpless.

The next paper, entitled "Alloys of Copper with Electrolytic Iron," by C. F. Burgess and James Aston, was read by Mr. Burgess.

IRON-COPPER ALLOYS.

The authors preface their paper with a résumé of the work of previous investigators on the subject of iron-copper alloys, etc., and then proceed to give a detailed account of experiments carried out at the University of Wisconsin on electrolytic iron and its alloys, credit for much of the work being given to Messrs. Watts, Kowalke and Thickens. The primary element in the production of these alloys is iron of high purity, obtained by double electrodeposition. The purity of the iron was given as 99.97 per cent. The copper used was also of high purity, being obtained by electrodeposition. The charges were made up in dense electrically shrunk magnesia crucibles, each enclosed in a graphite container. The crucible was covered with a magnesia lid and was buried in an electric resistor furnace. The charges were brought to fusion in the furnace (without agitation) from the cold mixture, kept at high temperature for some time, and allowed to cool in the furnace. The ingots weighed about one pound each, were forged under the steam hammer into rods about eighteen inches long, and were then turned or ground into the finished test rods. Observations were as follows: Alloys up to two per cent copper forge well at low heats; from two to seven per cent copper they forge only (and indifferently) at a white heat; from seven to eighty per cent copper they are practically unforgeable; from eighty to 100 per cent copper they will forge at a fair red heat, but not at a normal forging heat for iron. With percentages less than five per cent copper the alloys weld easily; up to seven per cent with difficulty or not at all; above seven per cent they are practically unweldable. The hardness seemed to increase with the copper content within the range of the experiments undertaken. In the tensile tests (unannealed specimens) the rise in the ultimate strength and the elastic limit proved to be almost a linear function of the percentage of copper. The ultimate strength varied from 61,180 pounds per square inch for the 0.1 per cent (copper) alloy to 132,400 pounds at seven per cent. The yield point rises from 52,580 to 122,900. Elongation falls from 28.5 per cent to 4.0 per cent for alloys of the same percentages. Reduction of area increases from 69.2 per cent for alloys containing 0.1 per cent copper, to 72.1 per cent for alloys containing 0.6 and 0.8 per cent copper; and falls from this point to 7.3 per cent for the seven-per-cent-copper alloy. The results of annealing showed a very marked effect, especially for the higher percentages of copper, and greater consistency was obtained in the results. Comparisons with the results of other experimenters were given, and these agreed closely with those of the present investigations.

Dr. Carl Hering, opening the discussion, asked whether the copper might not perhaps, when alloyed with iron, act differently on the physical properties, depending upon the treatment of the iron; that is, whether or not the copper may not take on some temper and thus add to the hardness. In other words, the chemical analysis is hardly the criterion of what the physical properties would be.

Prof. J. W. Richards said that, speaking from a metallurgical side, this paper will be received with great interest by the manufacturers of steel in the United States. He was told privately some years ago by a chemist of one of the large steel works, for his own private information, that a great deal of their steel had from 0.5 to 0.7 copper in it, and passed all the requirements of the U. S. Government, and it was not injurious to the steel, but rather beneficial. That was then private information. Professor Burgess' paper makes it public information, and even goes further than the information that was then known. He thought it was one of the most important papers, in its commercial aspect, that have been brought before the society.

Arthur H. Elliott said that the addition of copper to iron for certain purposes is extremely interesting, and probably the most interesting is that of its effect on the corrosion of the metal, especially in the making of pipes.

Roger C. Aldrich asked whether any experiments were made on the addition of copper to steel.

Professor Burgess replied that they did not make a series of copper alloys on the steel. They made enough accidentally to find that in the presence of carbon the copper acts in a way entirely different from that described in the paper. It makes it brittle. It makes it very short, and it is not desirable to add copper, at least, to high-carbon steel. As to the corrosion, they had been studying that quite extensively, and have several hundred alloys which are exposed to various corrosive conditions, but he was inclined to think that copper-iron is going to be a rather corrodible material.

Edward R. Taylor then read his paper, entitled "Contribution to the Electric Smelting of Iron Ore."

ELECTRIC SMELTING OF IRON ORE.

It is the opinion of the author of this paper that the necessity for large furnaces for the electric smelting of iron ores will be upon us in the very near future, and it is often the case that plans that serve for small demonstrations are not well adapted for large operations. In this connection the carbon bisulphide electric furnace now in use offers some suggestions that are worthy of consideration, and the paper is devoted almost entirely to a detailed description of this type of furnace.

Pedro G. Salom, commencing the discussion, asked if Mr. Taylor had made any measurements of the amount of current in kilowatt-hours per ton of iron.

Mr. Taylor replied that he and Mr. Hering had made some calculations along that line, but they were not in his mind at the time. It is a matter of surprise, he said, how little electric current is required for these transformations. It is also interesting to note how small the quantity of carbon is which is required for the reaction. When you dispense with the blast passing through a blast furnace, you dispense with several things—you dispense with a large quantity of nitrogen going into the furnace, a large quantity of carbon otherwise going into the furnace, and consequently you have reduced to a simple proposition a great many other things.

Prof. J. W. Richards criticized the structure which Mr. Taylor has proposed,[1] particularly in respect to the feeding of the ore separately from the fuel, and keeping them separate until they go down in the furnace. It is a wrong practice in the working of a shaft furnace, he said, to keep the ore by itself and the fuel by itself. The fine ore, particularly, packs, and the reducing gases cannot pass through it. Therefore, the possibility of utilizing the CO, and having a high percentage of CO_2 in the gases, can be attained only imperfectly with such an arrangement. He opined that the furnace is not adapted to securing high efficiency of consumption of carbon, or in the evolution of the heat of oxidation of the carbon. In connection with the name of this furnace, he asked all those present to use their influence not to have the furnace called the electric blast furnace. In Germany they call it *Elektrische Hochofen,* which is quite natural, and in France they call it *haut-fourneau electrique,* and if we call it the electrical blast furnace it will be giving it a misnomer. Let us call it the electrical shaft furnace, he said, and then we will not be committing this crime upon the English language.

C. A. Hansen said it is due as a courtesy to Doctor Haanel to use the term "shaft furnace." Doctor Haanel has contributed so largely to the literature of the shaft furnace, that he thought the suggestion of Professor Richards was well taken.

Professor Richards said that Doctor Haanel called it in his paper the "electric high furnace." He took issue with the doctor on the term, and he saw the point, and changed it accordingly.

Several others contributed to the discussion of this paper.

The next paper, entitled "Power for Electrolytic Copper Refining at the Smelting Works," was presented by the author, W. L. Spalding. There was no discussion.

Alfred Sang then read his papers on "Electro-Cementizing" and "Notes on Zinc, Copper and Brass Dusts." An abstract of the former paper follows:

ELECTRO-CEMENTIZING.

The author began with an outline of the usual methods employed in zinc-coating, with a review of the disadvantages and defects of the same. He then proceeded to describe his own (patented) process, called by him "electro-cementizing," the principle of which was by no means new, inasmuch as the Cowper-Coles "sherardizing" process, and another method described by M. Dumas as long ago as 1865, were somewhat similar as to the methods employed. The germ of the "electro-cementizing" idea lies in the fact that the articles to be coated are heated electrically by using them as resistances, and the author admitted that unless the process could be applied on a large scale it was applicable only in the case of articles of small cross-sectional area. The coating chamber or furnace of the apparatus used is made of iron plates lined with a refractory material, and is filled from the top with a mixture of crushed coal and oxide of zinc. The wire to be coated passes from the reels over and around insulated brass contact sheaves, those at each end being connected through the proper rheostat to the poles of a suitable transformer supplying low-tension alternating current. When all the strands of wire are in place and connected, the current will pass in a zigzag manner in and out of the furnace, and a wire resistance of considerable length is thus afforded. The current is turned on and regulated so that the wire is quickly brought to a bright cherry-red heat, which volatilizes adhering grease, reduces scale or rust by virtue of the contact with the reducing carbon, drives out occluded gases, and reduces the zinc oxide in the immediate neighborhood so that zinc vapor is absorbed by the pores of the wire and further condenses on the wire surface as the temperature of the wire is reduced. The quality of the product is due to the intimate alloy of the iron with the zinc and to the coating of pure zinc on top of this. The process combines in itself the annealing furnace, the cleaning process and the zinc bath, and does away entirely with fluxing and wiping. Oxides of other metals besides zinc may be used. The cost is somewhat higher than that of the hot zinc bath, but the resulting product is very superior in quality.

M. K. Thompson's paper, "On Calcium Carbide," was abstracted by the Secretary.

ON CALCIUM CARBIDE.

The following is the author's summary of the results of his experiments: 1. It was shown experimentally that the equilibrium pressure of carbon monoxide cannot be obtained by heating lime, carbon and carbide or lime and carbon alone initially in a vacuum, on account of the decomposition of the carbide into calcium and carbon and the subsequent reaction of carbon monoxide and calcium.

2. Hansen's results cannot, therefore, represent equilibrium. This was further demonstrated from theoretical considerations.

The paper was briefly discussed by Mr. Hansen. This concluded all the papers.

RESOLUTIONS.

A resolution of thanks was then passed to the various companies whose plants had been inspected on Friday by the delegates, to the Chemists' Club, Columbia University, the New York Section of the American Electrochemical Society, the Ladies' Committee, and the local Committee of Entertainment, after which President Baekeland expressed his thanks to the members for their attendance at the Convention, which had been in every way successful, and the meeting then adjourned.

Several of the papers set down on the programme were not presented, but in the main the plans of the meeting were well carried out.

[1] See Patent No. 938,351 in Record of Electrical Patents in this issue.

ELECTRIC LIGHTING and ILLUMINATING ENGINEERING

Illumination of the Minnesota State Fair.

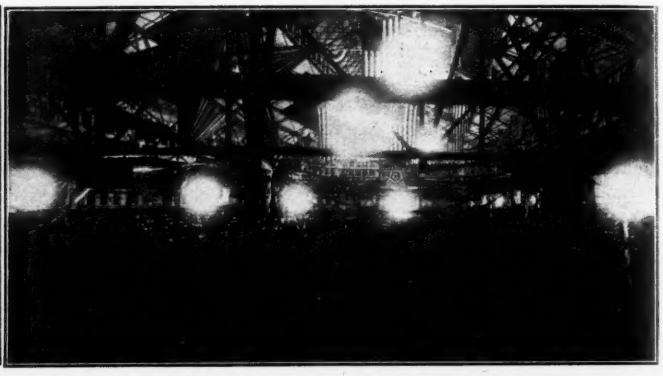
Visitors to the fiftieth annual Minnesota State Fair, which was held September 6 to 11, unquestionably were impressed by the brilliant illumination everywhere in evidence. They no doubt had difficulty in believing that about a dozen years ago this same fair was a dark, forbidden spot after sundown each evening. Electricity and the "Night Show" were unknown to that or any other state fair prior to the fall of 1898. The comparatively primitive lighting then was effected by an old engine and two series arc machines furnishing forty lights each, with a lone searchlight of 8,000 candlepower. The "Night Show" was a doubtful experiment that year and was confined almost entirely to the grandstand show and the fireworks.

The following year another series arc machine was installed at the Dale Street substation in St. Paul, and a few additional lamps were added. The real era of electricity at the Minnesota State Fair was ushered in by the building of a temporary transformer station and making a connection with the transmission lines of the General Electric Company, running from the big power plant at Taylors Falls, fifty miles away. Since that time the current has been transmitted direct to the state fair grounds at 13,200 volts and goes to the now permanent transformer station on the grounds of 1,500 horsepower capacity.

Since the installing of the transformer station the state fair grounds have closely resembled the traditional fairyland at night, and the illumination of the fair this year surpassed that of any previous.

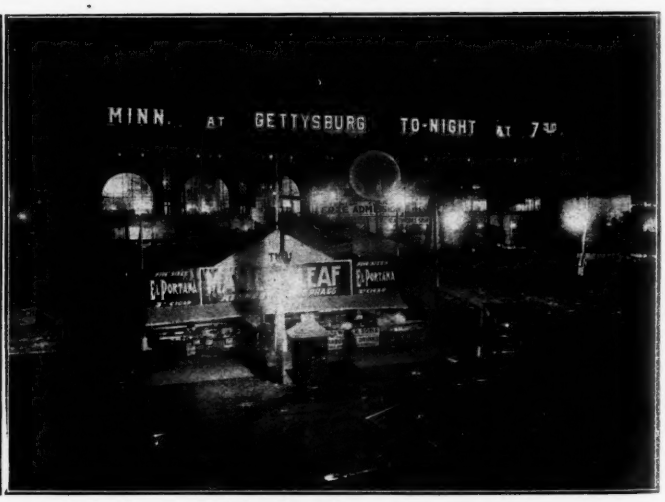
The grounds were lighted by 175 series arc lamps of 800 candlepower each, and as several sections of the grounds were used for daylight demonstrations only these lights were concentrated in order to make brighter the 200 acres upon which the activities of the "Night Show" were most in evidence. For lighting the new $250,000 grandstand in which the "Minnesota at Gettysburg" production was held, forty Excello flaming arc lamps and about 1,600 decorative incandescent lamps of eight candlepower each were used. The

Grandstand.



Ampitheatre.

Automobile Showroom.



Approach to the Grandstand.

ILLUMINATION AT MINNESOTA STATE FAIR.

automobile showroom, shown in one of the accompanying illustrations, was made more brilliant by ten Excello flaming arc lamps, forty multiple arc lamps and 1,000 incandescent lamps, the latter purely for decorative purposes, over and about the booths. The second floor and the main approach leading to it were lighted by eight Excello flaming arc lamps and sixteen multiple arcs.

Another item in the extensive scheme of illumination was the electric sign hung upon the approach side of the grandstand announcing "Minnesota at Gettysburg, 7:30 Tonight." This sign was twenty feet high and 350 feet long and required 1,300 four-candlepower incandescent lamps. A view of this sign, together with the exterior illumination of the approach of the grandstand, is shown herewith.

Next to the grandstand and exposition building the live-stock amphitheater was perhaps the most brilliantly lighted of any of the buildings on the grounds. For lighting the interior, twenty Excello flaming arc lamps were used and 1,500 ten-candlepower incandescent lamps used for decorative purposes.

Other buildings were illuminated in a similar manner, flaming arc lamps being the principal illuminants, with incandescent lamps for decorative purposes.

The electric-lighting and power system at the Minnesota State Fair represented an investment of $50,000.

A Fluid-Electrode Arc Lamp.

One of the latest forms of arc lamps, and one that promises a good deal as to convenience and economy, is the plastic-electrode lamp, for which a patent was secured last month by Caryl D. Haskins, of Schenectady, N. Y., and assigned by him to the General Electric Company.

In this new type of arc lamp the old form of carbon electrode is not used, but instead, the electrode material is introduced in the form of electrode "mud," which is molded and baked into electrodes as it is fed. The electrode mud, composed of powdered coke, lampblack, anthracite and bituminous coal and a suitable agglutinant, is fed into the electrode chambers in a plastic state, pushed by its own weight through the electrode tubes and baked by suitable heating coils.

Fig. 1 shows a longitudinal central cross-section of one form of this lamp; Figs. 2 and 3 are modifications.

Referring to Fig. 1, 1 and 2 are receptacles having downwardly extending tubular portions 3 and 4. Into these receptacles the fluid electrode material is put from time to time as the electrodes are fed and consumed.

As the current is turned on, the parts surrounded by the heating coils 10 and 12 are baked, this baking process taking place as long as the lamp continues to burn. Both electrodes are fed in exactly the same way as in an ordinary arc lamp. Assuming that the electrodes are in contact and the current has begun to flow, the upper electrode is lifted the proper distance by the clutch 12 operated by the

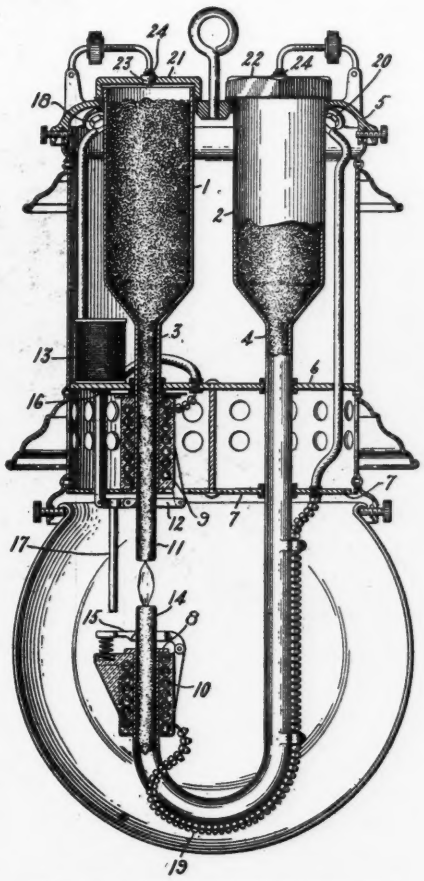


FIG. 1.—HASKINS' FLUID-ELECTRODE ARC LAMP.

electromagnet 13. When the arc breaks, the electrode drops and is again lifted. Each break of the circuit drops the rod 17 on the clutch 15. This allows the lower electrode to be pushed upward by the weight of electrode material in receptacle 2, and in this way the length of the lower electrode is expected to be kept practically constant.

The circuit of this form of lamp may be traced as follows: Beginning with the positive terminal 18, the current passes through the coil of magnet 13, thence through the heater 9 to the tube 3 and electrode 11 to electrode 14 and tube 8, thence through the heater 10 and by way of an insulated conductor 19 to the negative terminal of the lamp 20.

Instead of depending entirely on the weight of the fluid to supply the electrodes, auxiliary pressure devices may be employed, as, for example, making use of the gas pressure generated by the heat-

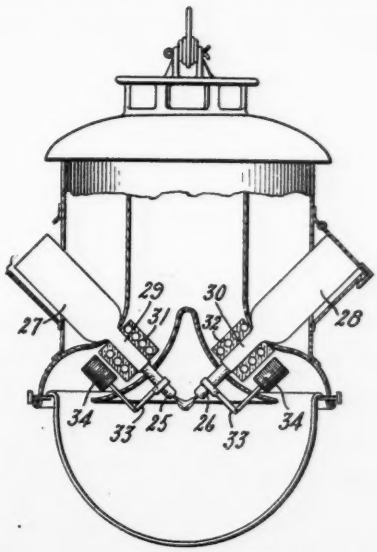


FIG. 2.—HASKINS' LAMP WITH CONVERGING ELECTRODES.

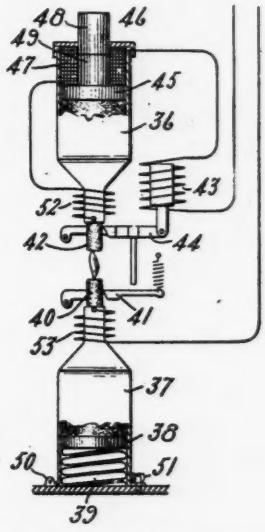


FIG. 3.—HASKINS' LAMP WITH UPPER AND LOWER CHAMBERS.

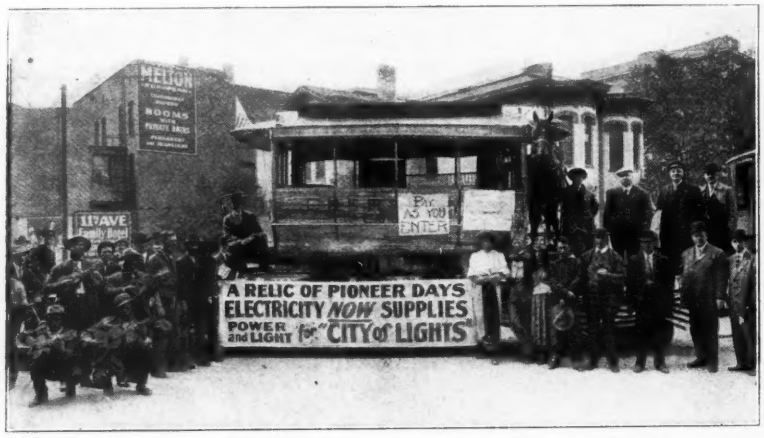
ing process. This is done by tightly closing the tops of receptacles 1 and 2 by screw-caps which may be provided with safety valves 24.

These may be regulated for any desired pressure.

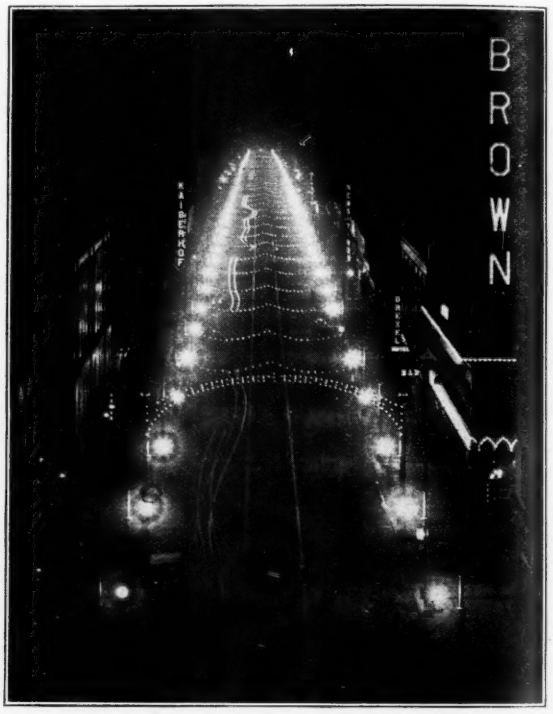
Other forms of this lamp are shown in Figs. 2 and 3, the former being a type with two converging electrodes, and Fig. 3 feeding the bottom electrode by a spring and the upper by a solenoid.

The Old and the New Strikingly Contrasted at Denver.

The new order of things was strikingly contrasted with the old at the convention of the American Street & Interurban Railway Association in Denver recently by a street exhibition of the famous Cherrelyn horse car, which is one of the sights for the tourists visiting the western city. The Denver Gas and Electric Company induced the owner of the line, which is just outside the city limits, to suspend business for a day so that the car could be used for exhibition purposes. It was placed on a flat car and brought to the door of the convention hall, where a large number of delegates had their pictures taken with the car as a background. To carry out the pioneer effect, a number of the employes of the Denver Gas and Electric Company dressed as miners and cowboys to portray conditions of the early days. The feature was greatly appreciated by the delegates to the convention.



A REMINDER OF THE OLD DENVER.



STREET LIGHTING IN THE NEW DENVER.

The new Seventeenth Street lighting was completed in time for the inspection of the visitors. This street, which leads from the Union Depot, is now the best lighted in the city. There are eight arcs to a block and the poles are artistically designed. A number of stringers were used for additional lighting for the convention and the reputation of Denver as the "City of Lights" was thoroughly lived up to.

Locomotive Headlight Tests.

The exhaustive test of the respective merits of oil and electric locomotive headlights recently begun on the Big Four Railroad near Avon, Ind., by the Railroad Commission of Indiana, a number of railroad officials and many prominent engineers, is being continued at Purdue University and is expected to result in some interesting disclosures to the railroad world.

The tests were brought about by an act of the Indiana Legislature, which instructed the Railroad Commission to investigate the merits of various types of locomotive headlights and to order every railroad in the state to put into service the type of headlight which was found to be most efficient.

The tests were made under three heads: The first was a test in which the effect of opposition headlights was utilized; the second test was simply an observation of the distances at which classification signals on the locomotive could be seen when electric and oil headlights were used on the same locomotive; and the third test was the observation of distances at which obstructions on the track could be easily distinguished.

Members of the commission have not as yet been able to agree, and the outcome of the investigation will be awaited with interest.

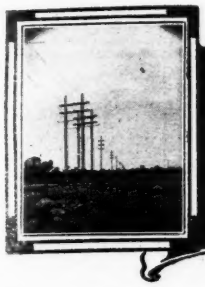
Gross Earnings of Boston Edison Illuminating Company Show Signs of Increase.

Charles L. Edgar, president of the Edison Electric Illuminating Company, Boston, estimates that the company will increase its gross earnings more than $600,000 a year by the new contract with the subsidiary companies of the Boston and Suburban Electric Company, to supply all the electricity to be needed in the operation of their street railroads and, by the recently consummated purchase of the electric properties in Newton, Chelsea, Watertown, Brookline, Brighton and Waltham, as well as by the disposition of the gas properties located in Newton, Chelsea and Watertown.

If the expectations as to gross earnings are realized and if expenses are only proportionately increased, the company should show a small surplus as a result of the business of the current year, even after paying ten per cent dividends. The total of the liabilities of the company amounts to $24,866,608, about thirty per cent of which, or $7,604,940, is counted as premiums on new stock. The capital stock during the year was increased by $960,000, and at the same time notes and accounts payable were decreased $645,090. Notes and accounts payable have been largely increased since June 30, as is seen by the fact that the company has petitioned the Gas Commission for authority to issue 19,452 shares of additional capital stock, proceeds of which to be used to take up notes issued for new properties acquired at a cost of about $2,870,000, also to take up notes issued from time to time to take care of the normal growth of business amounting to $1,000,000.

Telegraphy at Panama.

A contract has been entered into between the Panama Railroad Company and the Republic of Panama, providing for the construction and maintenance of telegraph circuits between Panama and Colon.



CENTRAL-STATION PRACTICE

Transmission—Interior Wiring.

THE ADVANTAGES TO ELECTRIC COMPANIES OF CENTRAL-STATION STEAM HEATING.[1]

BY CHARLES R. BISHOP.

Before taking up the present state of district steam heating, it may be well to touch a little upon the history of the enterprise.

At the time of its conception, in the year 1876, there was no practical knowledge of anything pertaining either to construction or operation, maintenance of underground lines, the quantity of heat required in various classes of buildings, cost of generating and delivering steam, or any data upon which to base the charges for services rendered. A number of years passed before sufficient data had been collected to determine what had been the causes of excessive transmission losses, large repair bills, and generating costs so high that profitable and satisfactory operation was difficult. Notwithstanding the fact that the early results had been unsatisfactory, it appeared to those most directly interested that there remained enough of an encouraging nature to justify further effort. Experiments were continued upon a much larger scale and many different kinds of insulating materials were thoroughly tested, together with several methods of providing for expansion and contraction. In this way the enterprise progressed along lines of improvement in construction and insulation, but with little attention being paid to economy in generating steam, to methods of selling, or to general management.

In 1880, and during the early period of development, a system of steam mains was installed in Lynn, consisting of long lines of pipe of small diameter, designed to carry relatively high pressures, very imperfectly insulated and with practically no protection against the effects of water which more or less surrounded the mains. The construction of the plant was carried through without appreciation of engineering requirements, no provision made for relieving the mains of condensation except through entrainment; boiler-house economies were not considered, and the management was entrusted to men without experience and wholly incapable. The result is obvious.

About the same time, a plant was installed in Springfield, Mass., under practically the same methods of construction as were used at Lynn, but, with better management, succeeded in supplying service for over twenty years.

Other failures of steam-heating plants occurred, however, in various parts of the country, but totaled less than a dozen, with causes of failure due to the same sources in all instances, namely, poor construction and insulation of the underground system, management left to inexperienced men, a lack of proper means and methods of charging for steam consumed, and a deficiency in data of all kinds. Contrast the few failures with the great number of successes which total more than 200 cities!

In the New England states there are 172 cities having a population of over 5,000, and still in but three of them is there a district heating system of any magnitude, while Pennsylvania, having eighty-two cities of over 5,000 inhabitants, can claim central-station heating plants in at least sixty-nine cities. Illinois has fifty-one cities of 5,000 population and over, out of which thirty have more or less extensive systems of heat distribution, and in addition, there are heating plants in eight cities in Illinois of less than 5,000 population.

The question that now suggests itself is, Why are so few New England cities supplied with this service? Is it on account of climatic conditions? No, because steam heating is a success as far south as Birmingham, Ala., where snow is almost unheard of and the mean winter temperature is higher than the mean temperature of October, alone, in New England. Is it on account of the heating season not being of sufficient length? Certainly not. Is it on account of a lesser difference between the cost of fuel to the central-station company and to the consumer? No, statistics are proof of that. Is it on account of local conditions? It cannot be said that that is the reason; in fact, there is not a reason, but on the contrary every reason is decidedly in favor of district steam heating in New England as compared with any other section of the country.

The heating season here is regarded as of more than average length and severity. The cities are more compactly built, particularly the residence portions. The cost of fuel for central-station use as compared with that purchased by the individual user is in favor of district heating. The class of business available is better, and the prosperity of the community is acknowledged to be greater than in other sections.

As the methods of construction of steam-distribution plants are at last recognized to have become standardized, and descriptions have been given from time to time in the various engineering publications—or for those who may not have read such articles, information can be procured from manufacturers and contractors—it would be of greater interest at this time to touch upon that phase of the enterprise designated as "Results of Operation," under which there are two principal subdivisions: (1) Results comprising the operation of "live-steam" plants, or those which supply no other public-utility service other than steam for heating. (2) Results of "exhaust-steam" plants, or those which supply steam for heating, but only utilizing for this purpose the exhaust steam resulting from the operation of electric plants.

Since this association is composed of representatives of electric-light and power companies, let us devote ourselves to a consideration of the "Commercial Possibilities of Operating an Exhaust-Steam-Heating Plant in Connection with the Operation of Present Stations."

Is there a market and demand for a

[1] A paper (slightly condensed) read before the New England section of the National Electric Light Association, at Newcastle (Portsmouth), N. H., September 9, 1909.

central-station supply of steam for heating purposes? I think you all will agree that there is, and no doubt many of you have been approached by owners of business blocks or residences to furnish a supply of heat, and others have been disappointed that their solicitors of contracts for lighting and power have not succeeded in procuring a considerable amount of additional business which would readily have been secured had you been able to supply steam for heating as well as electricity for light and power from your present central-station facilities.

Is there as good a market for steam heat as there is for electric light and power? I believe there is a better market. In a sense, electric light can be regarded as a luxury; so also can a public distribution of water, of gas, or of street-railway service. To no one of us is a public service of any of the above-mentioned commodities necessary. In this locality we can live without artificial light; if we arise with the sun and work until it sets, we would labor more hours than the average man now works; we need not have our residences or places of business supplied by a water company, since we can live without such service, taking our supplies from waterways, wells or cisterns; in place of riding on street cars, we could live downtown, walk, ride a bicycle, or drive a horse. But heat is recognized as an absolute necessity for the maintenance of human life; it cannot be secured in this latitude from nature's sources during winter; it cannot be successfully stored for long periods of time; it must in some manner be manufactured for immediate consumption; and, therefore, it is demanded of public-service companies to a greater degree than are the other named commodities.

Can your company supply heat at a cost comparable with that at which an individual himself can produce it? It is a fact that many of you are manufacturing heat in the form of steam, but what becomes of it? From eight to fourteen per cent of it is converted into mechanical energy in the form of electricity, and the balance thrown away, either into the atmosphere or into condensers. The plant operating non-condensing may have eight per cent heat efficiency, and the condensing plant a possible fourteen per cent conversion. Why not sell this large amount of otherwise lost energy for a price which will pay the original total fuel cost, including also such other expenses as water, oil, waste and labor, in boiler and engine room? Can it be done? Yes. Others are not only doing that very thing, but are also earning interest and depreciation on the cost of the steam-distributing system. In this connection, let me cite the results of a few companies:

PLANT NO. 1.

Electrical output	1,902,970 kilowatt-hours
Coal consumption	16,383,649 pounds
Water, all purposes	145,302,510 pounds
Coal cost	$21,091.82
Water cost	692.77
Oil and waste	596.36
Boiler-room labor	2,473.37
Engine-room labor	2,008.88
Total	$26,863.20
Steam receipts	37,190.35
Average net rate	40 cents per 1,000 pounds
Steam investment outside of station, including street mains, services, trenching, repaving, street traps and meters	$122,070.16
Space heated, approximately, October 1, 1908, to May 25, 1909	10,000,000 cubic feet

Combination plant, operated three seasons. City of 17,500 population.

PLANT NO. 2.

Electrical output	541,767 kilowatt-hours
Coal	6,768,661 pounds
Water, all purposes	48,131,094 pounds
Coal cost	$ 7,974.55
Water cost	463.20
Boiler-room labor	1,029.00
Total	$ 9,466.75
Steam receipts	12,497.85
Average net rate	40 cents per 1,000 pounds
Steam investment, approximately, October 1, 1907, to May 1, 1908	$45,000.00

Combination plant, operated five seasons. City of 10,000 population.

PLANT NO. 3.

Electrical output	1,081,150 kilowatt-hours
Coal	14,448,399 pounds
Water, evaporated	86,296,235 pounds
Coal and water cost	$22,904.05
Oil and waste	568.01
Boiler-room labor	2,305.45
Engine-room labor	1,271.65
Total	$27,049.16
Steam receipts	35,053.45
Average net rate	60 cents per 1,000 pounds
Electrical receipts for same period	$43,359.64
Steam investment, approximately, heating season October 1, 1908, to June 1, 1909	$45,000.00
Space heated	7,976,796 cubic feet

Combination plant, operated eight years. City of 10,000 population.

PLANT NO. 4.

Electrical output	2,498,508 kilowatt-hours
Coal	24,837,136 pounds
Water, all purposes	177,053,950 pounds
Coal cost	$15,523.21
Water cost	1,072.39
Oil and waste	370.48
Boiler-room labor	4,432.97
Engine-room labor	2,378.86
Total	$23,777.90
Steam receipts	25,931.68
Average net rate	27 cents per 1,000 pounds
Steam investment, approximately, October 1, 1908, to June 1, 1909	$103,000.00
Space heated, approximately	16,000,000 cubic feet

City of 43,000 population.
Note.—Steam rate should be at least 60 per cent higher.

Another interesting manner of studying the foregoing results would be to add to actual generating costs, interest and depreciation on the investment for steam mains, which is not properly an item of generating cost, but is included in order to get any cost whatever per kilowatt-hour.

PLANT NO. 1.

Boiler and Engine-Room Costs.

8,191 tons bituminous coal at $2.575 per ton	$21,091.82
Wages, firemen and helpers	2,473.37
Wages, engineers	2,008.88
Water	692.77
Miscellaneous supplies	596.36
Total	$26,863.20
Add to the above 10 per cent for interest, depreciation, etc., on steam investment	12,207.01
Total	$39,070.21
Receipts from sale of steam	37,190.45
	$ 1,879.76

Totalized switchboard cost per kilowatt-hour, including interest and depreciation on steam investment, $1,879.76 divided by 1,902,970 equals 0.0987c.

PLANT NO. 2.

3,334 tons, 661 pounds coal, costing	$ 7,974.55
Boiler-room wages for seven months	1,029.00
Engine-room wages (assumed) for seven months	980.00
Water	463.20
Oil and waste	100.00
Total	$10,546.75
Interest and depreciation at 10 per cent on steam investment, approximately, of $45,000.00	4,500.00
Total	$15,046.75
Heating receipts	12,497.85
	$ 2,549.90

Totalized switchboard cost per kilowatt-hour, including interest and depreciation on steam investment, $2,549.90 divided by 541,767 equals 0.47c.

Note.—As their heat customers are heating for only about two-thirds of the previous cost to them when generating with their own apparatus, this company's rate should be 50 per cent higher, with a corresponding increase in revenue.

PLANT NO. 3.

7,224 tons, 399 pounds coal, including water	$22,904.05
Wages in boiler room	2,305.45
Wages in engine room	1,271.65
Oil and waste	568.01
Total	$27,049.16
Add to the above 10 per cent for interest and depreciation on investment of, approximately, $45,000 in steam mains	4,500.00
Total	$31,549.16
Heating receipts	35,053.45
Surplus	$ 3,504.29

Note that after paying all generating charges, also interest and depreciation on investment in steam mains there remained a totalized switchboard surplus per kilowatt-hour of $3,504.29 divided by 1,081,150 equals 0.324c.

PLANT NO. 4.

12,413 tons, 1,136 pounds coal, costing	$15,523.21
Wages in boiler room and hauling coal and ashes	4,432.97
Wages in engine room, including oilers	2,378.86
Water	1,072.39
Oil and waste	370.48
Total	$23,777.91
Add to the above 10 per cent for interest and depreciation on investment of $103,000 in steam mains, etc.	10,300.00
Total	$34,077.91
Heating receipts	25,931.68
	$ 8,146.23

Totalized switchboard cost per kilowatt-hour, including interest and depreciation on steam investment $8,146.23 divided by 2,498,508, equals 0.325c.

Note.—These results being obtained while selling steam for practically 50 per cent of what should be charged and compete with cost of fuel to individual users in that city.

Let us now consider the results secured by companies operating plants which supply no public utility other than steam heat.

PLANT NO. 5.

Season 1908-1909.

Fuel	32,644,166 pounds
Water consumption, all purposes	261,216,438 pounds
Total operating cost, fuel, water, boiler-room labor, including salaries, taxes, repairs, etc.	$34,598.72
Income from sale of steam, maximum rate of 40 cents per 1,000 pounds	57,004.88

This company pays regularly a 6 per cent annual dividend and has created in addition a surplus of approximately $60,000.00, which surplus is equal to 50 per cent of capital stock (no bonds issued).

Space heated	22,811,900 cubic feet

PLANT NO. 6.

Fuel	40,337,248 pounds
Water consumption	302,917,521 pounds
Cost coal hauling, removing ashes, etc.	$27,529.31
Cost of firing, water, boiler-house labor, taxes, salaries and sundries	19,340.50
Income from sale of steam	72,071.10

Net earnings for the past season approximately 14 per cent, which is about the average result of this plant.

Space heated	15,939,907 cubic feet
Plant investment, including real estate	$176,618.67
Capital stock issued (no bonds)	177,000.00

You will note by a comparison of these two live-steam plants, that the latter com-

pany manufactured over fifty-seven per cent more steam per cubic foot of space heated than the first-named company, and this difference is almost wholly accountable by the fact that one company charges for steam furnished upon the basis of consumption as shown by meter records, while the other company operates entirely under the flat-rate method. Applying the revenue per 1,000 cubic feet of space of the latter company to the space heated by the former, the gross revenue of the first named would then be approximately $103,110, or nearly eighty-one per cent greater than the present income.

Recently, an officer of that company was asked why they did not charge at least a sixty-cent rate, which would not increase the cost of heating beyond a point where the consumers could save money by operating their own plants, and his answer was: "Should we make such an increase in rates, either a new heating company would immediately be formed, and with a more modern and efficient plant compel us to reconstruct under today's standardized and improved methods of construction and insulation in order to compete with them, or force us out of business. As a second condition, our consumers would probably appeal to state authorities for an examination of our affairs to ascertain if such increase in rates was due to a lack of sufficient profit under present rates, and such an examination would show that in all probability we are earning a greater profit than the companies in this city now profitably operating such plants as electric light, street railway, gas or water."

I have chosen the two plants referred to, because they are operated in cities of approximately the same size, in the same state, under the same climatic conditions, and occupy the same class of territory.

I think you will all agree that the results given prove that exhaust-steam heating can be profitable in any city, and that plants furnishing no service other than steam heat are also profitable.

Influencing the degree of success of district steam-heating plants, there are several conditions, viz.: (1) The climatic conditions should be such as to insure a good market for the sale of steam. (2) The generating station should be reasonably adjacent to the districts which it is proposed to serve, simply in order to reduce the investment necessary to reach the business. (3) The local conditions under which steam is sold for heating should be such as will permit fixing a rate, which, while well within economic limits from the standpoint of the consumer, can still be sufficiently high to pay a satisfactory profit on the investment over and above the cost of manufacturing steam, including depreciation and amortization. (4) Efficient management. (5) The meter system of charging. (Measured service.) (6) The total amount of business secured to the total amount procurable. (7) The installation of the plant under standardized methods of construction which have proven efficient through years of actual operating experience, and by reason of which the transmission losses are reduced to a minimum, and depreciation low. An eighth condition should be included for "live-steam plants" operated purely as such, viz.: (8) A suitable and economical boiler plant and equipment.

In any city where a central heating plant is constructed, a sufficient territory must be reached by the underground system to insure a volume of business in which the profit existing between generating cost and selling price does not exceed fixed burden. Where the heat is supplied by exhaust steam a sufficient volume of business should be secured at least to utilize, during minimum-demand heating, the full amount of exhaust steam from any single engine unit. Station piping should be so arranged that any engine can be operated, condensing, non-condensing, or under back-pressure while furnishing steam for heating, without reference to the manner of operating any other engine in the station. This can be accomplished without much additional cost for piping, but is very often neglected, resulting in back-pressure being carried on a portion of the engine plant without compensating advantages. To secure maximum results, the demand for steam for heating should be slightly in excess of the maximum amount of exhaust steam available at all times.

Considerable care should be taken in the design of a proposed underground system of steam mains, and in order properly to determine its cost, gross and net earning power, the average and peak demands, and the probable effects upon present operating conditions, the method of procedure is generally as follows:

A careful examination is made of all the territory, both business and residence, within a distance of from one to one-and-three-quarter miles from the generating station, depending upon local conditions. Manifestly, unfavorable districts are then eliminated; a scaled map is made of the balance of the territory upon which is shown the location and cubic feet of space of each of the buildings contained therein. Upon this map there should also be noted the type of building construction (wood, brick or stone); classification indicated (retail or wholesale business, manufacturing, public building, hotel, boarding house, apartment house, theatre, residence, etc.). Information is also secured from local records, or from the nearest source, covering the maximum, minimum and mean monthly outdoor temperatures, average monthly wind velocity, and average monthly relative humidity. Then with this information collected and using compiled data covering average and peak monthly heat demands in the various classes of buildings to which service has been rendered in other cities having similar climatic conditions, the average, peak and total steam demands in each block can be determined and noted on the map. In this manner the steam demand is calculated for each block from the extreme point of delivery back to the station, resulting in a fairly accurate estimate of quantity of steam that will be required for the heating season, each month and at peak demands. The size of mains from the station and in the various blocks is determined by using tables of carrying capacities of modernly constructed and properly insulated underground steam mains, operated under a maximum initial pressure of five pounds above atmosphere, and transmission drops of one-quarter pound per 1,000 lineal feet of main. As much or as little of the ultimate completed system may then be installed as is deemed desirable for the first year's construction, and these mains will be of proper size to meet the inevitable growth of the plant, without eventually resulting in serious overloading, with its attendant excessive back-pressure, or impaired service.

When available, monthly station records of coal and water consumed in the manufacture of electricity are plotted graphically, the monthly demand for steam is likewise plotted, hourly and monthly electrical output considered, and thus the extra amount of fuel and water required is found. With the known cost of fuel, water, etc., it becomes a simple matter to calculate what will be the increased operating expense. The curve of steam demand at the generating plant is made up of consumers' demand, trans-

mission losses, and unaccounted-for steam.

The next step is to establish a rate at which the steam is to be sold, and this depends strictly upon local conditions. As a general rule, the average rate per thousand pounds steam sold is approximately ten per cent of the cost to an individual user of a ton of anthracite coal, if that is the kind of fuel generally used. As an example, where anthracite coal is sold to the consumer at $7 per ton, the central-station company should receive an average of seventy cents per thousand pounds of steam, which rate would be slightly in favor of the consumer on a basis of actual heat-unit efficiency. Cumulative sliding-scale rates are usually adopted in order that automatically the larger consumer should pay a lower average price per thousand pounds of steam than the smaller consumer, the justness and reason of which is apparent.

The investment is made up of cost of power-plant connections, street-distributing mains, service mains, trenching and paving, consumers' and street meters and street traps. With these costs known, together with the cost of generating and operating, amount of transmission loss (which is a fixed quantity dependent upon the number of square feet of surface of underground mains), and probable income from the different buildings, the profit which will accrue when serving any given percentage of the total available business in the whole territory or any portion of it, may be estimated within a reasonable degree of accuracy.

It is not necessary nor would it usually be advisable to cover the full amount of territory in the first year's installation, but a sufficient amount should be covered to insure profitable operation.

Another very important factor must also be considered, namely, the additional amount of electrical business that can be secured through your ability to furnish, not only electric light and power, but heat, with the additional profit resulting from such increased electrical sales. A feature of possible greater importance is the fact that with an extensive heating plant operated in connection with electric light and power, you are practically insured against a competing plant being installed, even though the threatened competition may be of hydroelectric nature. I make this statement understandingly. Illustrative of this feature, I will cite the following instance:

In a certain city there existed a company furnishing all the gas and electricity used with the exception of the street-railway load. It had a station equipped with boilers, engines and generators, to be used in emergency times; it had its own hydroelectric plant, but of somewhat limited capacity, and it also had a contract with a nearby hydroelectric company, covering a long term of years, which agreed to furnish any amount of current up to a maximum of 30,000 horsepower, at a price close to 0.25 of a cent per kilowatt-hour, monthly bill being based upon the average of the highest, daily, one-minute peaks occurring during the month, but with no "firm horsepower" restrictions. The company sold current at rates which averaged less than a cent per kilowatt-hour.

In the same city there was a company operating an extensive system of district steam heating, which company installed a thoroughly modern steam-electric generating plant, consisting of well-designed. single-cylinder, four-valve engines, alternating-current generators, etc. Within six months they secured a majority of the commercial lighting business, practically all of the residence electric-lighting load and a fair amount of the smaller and higher-priced power business. This was accomplished without any cutting of rates, but due in a large measure to better and more uniform service, which is always true of a steam-driven electric plant as compared with a hydroelectric plant, with its usual long and extensive high-voltage distribution lines.

The competing companies were consolidated into a third company, with the company first in the electrical field in control of the stock of the consolidated company. An interesting fact now appears. In view of the favorable contract held by the company for the purchase of all the current ever likely to be needed, and with electric demand far in excess of the ability of the steam-generating plant ever to serve and not exhausting to the atmosphere, what method of operation would be adopted? Would the plant be kept for stand-by purposes, shut down as an electric plant, or continued in operation? Without changing any of the conditions the consolidated company continued for six months the operation of the steam-electric plant to determine, for themselves, the manufacturing costs under the combination of generating current and selling exhaust steam. The results were such that they then bought and installed additional steam engines and generators which more than doubled the former capacity, and have since, during heating seasons, operated the generators, not only to their full capacity, but with heavy overloads during peak-demand hours. Even throughout the night hours electricity is manufactured, although current could be supplied from the outside hydroelectric company at no cost to the local or purchasing company—due to the already-mentioned fact that the company purchases current on the one-minute peak basis, and the peak had already occurred, thereby fixing the bill for the twenty-four hours' service, this condition existing on account of the desire to increase the amount of exhaust steam.

More complete details and additional records of results in other cities can be given to companies desiring same.

It may be of interest to learn how transmission losses may be determined. At low points in the system of underground steam mains, at intervals of from 500 to 1,000 feet, depending upon local conditions, street traps are placed in manholes and the condensation discharged through meters. Service connections are always taken from the extreme top of the steam mains, so that practically all of the condensation of steam occurring in the distributing system reaches the traps and is measured by the street meters. This loss in modern system does not exceed the transformer core losses of most electric plants. It may be stated that the percentage of transmission losses and unaccounted-for steam is considerably less than the percentage of transmission, transformer and unaccounted-for losses of electrical distribution.

While it must be recognized that the construction cost of a steam-distributing system greatly exceeds the construction cost of an electrical distribution system, still it is a well-known fact that the average consumer pays many times more for heat than he does for light. The number of hours of steam service is fully thirty per cent greater than the total number of lighting hours of the year, and steam heating has the added advantage of being continuous during the twenty-four hours of each day throughout the heating season.

The rates for steam service supplied by an electric company should be based on the assumption that all steam sold will be manufactured expressly for heating service, and then there would be no question of there being a profit for all steam furnished in excess of the exhaust steam

utilized. Upon this basis no company need have any fear of contracting for additional heating business, being limited only by the capacity of the generating plant.

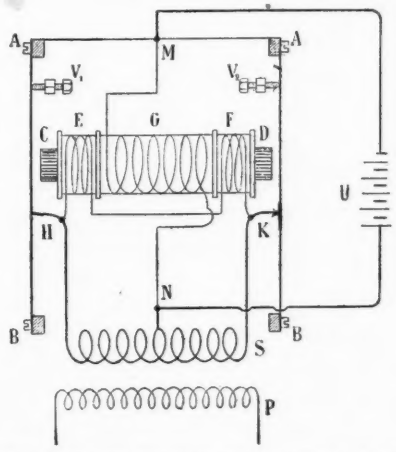
In conclusion, let me call special attention to a few important facts brought out in the foregoing: (1) Experimental period has passed—present development equal to that of other public utilities. (2) Underground construction standardized. (3) Meters developed to a high degree of accuracy. (4) Live-steam heating is profitable. (5) Exhaust-steam heating is more profitable.

Supplying heat from your present electric stations will increase: (1) Value of present investment. (2) Number of boiler-horsepower-hours, and the boiler efficiency. (3) Number of engine-and-generator horsepower-hours, resulting in increased electrical efficiency. (4) Number of heat units actually utilized of the total number manufactured, and very materially so. (5) Load and power-factors. (6) Kilowatt output. (7) Income from electric sales. (8) Income from plant operation. (9) Net earnings. (10) Dividends.

In addition it will improve the position of the company to keep out a competing company and to keep out isolated plants.

Vibratory Alternating-Current Rectifier.

A vibratory alternating-current rectifier capable of operating at all the usual commercial frequencies without previous adjustment has been constructed by A. Soulier. As shown in the diagram herewith, two sheets, A B and A′ B′, are held between two points, so that they can vibrate in the manner of a telephone receiver diaphragm, which follows all the different vibrations of the human voice. In the center each of the sheets carries a contact which, during the vibration, touches a fixed insulated contact, H or K. A soft iron core, C D, magnetized by a solenoid through which flows direct current or rectified current derived from the apparatus, carries at its ends two other magnetizing coils, E F, fed by alternating current from the supply wires. The polarized electromagnet so constituted communicates to the sheets a vibratory movement in synchronism with the alternating current. Two screws, V_1 V_2, serve for adjusting the distance between the sheets and insulated contacts and thus varying the duration of the contact. Normally the sheets do not touch the contacts, but they remain in connection with them for a longer or shorter period when the electromagnet exerts sufficient attraction. At small amplitudes this system vibrates in synchronism with the usual alternating-current frequencies of twenty-five to 100 cycles per second. The rectification of the current is obtained by connecting the two insulated contacts H K to the terminals of the secondary of a transformer S. Each sheet thus comes alternately in contact with one of the poles and transmits one or the other wave. The consuming devices, as accumulators U, are joined on one side to the neutral point N, and on the other M to the two sheets, which are electrically connected. The efficiency of an apparatus of this kind furnishing fifteen amperes at 110 volts is about ninety-four per cent. Three-phase current may also be rectified on this principle by employing three vibrating sheets. —*Abstracted from L'Industrie Electrique, Paris, September 25, 1909.*



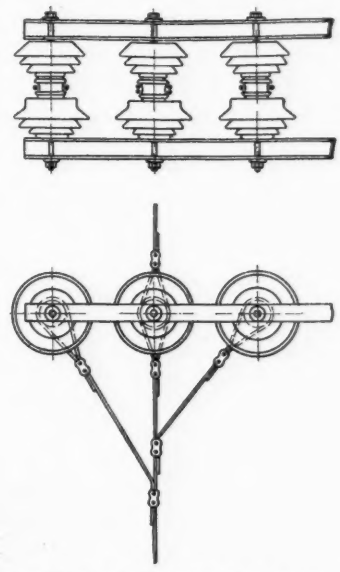
THE SOULIER VIBRATORY ALTERNATING-CURRENT RECTIFIER.

A New Radium Factory.

A new radium factory is in process of being built in Limehouse, London, Eng., whereof the foundation stone was laid on October 16 last by Sir William Ramsey. The factory will be controlled by the British Radium Corporation, and Sir William's own secret process for extracting the precious substance will be used in what is understood to be the first attempt to manufacture radium on a commercial scale. The pitchblende ore from which the radium will be extracted will come from the Trenwith mine, Cornwall, and meanwhile a plant has been erected near the mine at St. Ives, Cornwall, where the rough ore will be crushed and concentrated before being sent to London for final treatment.

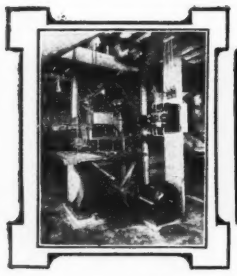
Safety Suspension for High-Tension Electric Conductors.

The employment of protective netting below or entirely surrounding high-tension conductors has so far been usually required at the crossings of important streets or roads in Europe. Experience has shown, however, that these protective measures possess many imperfections. An arrangement proposed by Dr. Klingenberg, and recently carried out by the Allgemeine Elektrizitaets Gesellschaft, is illustrated in the accompanying diagrams. If the conductor is fastened to only one insulator and an arc should form between the conductor and the support in consequence of over-tension or breaking of the insulator, the conductor may be fused and fall to the ground. It is therefore carried by three insulators, so that even after the rupture of two insulators the third one will maintain the conductor in nearly unchanged position.



SAFETY SUSPENSION FOR HIGH-TENSION CONDUCTORS.

In order to increase the mechanical strength, either special tension-relieving insulators between two cross-arms are employed, or with ordinary insulators the supports are strengthened. The connection of the two auxiliary wires at the sides with the main conductor is best effected by means of special cable locks, the mechanical strength of which has been previously tested. The overhead crossing of low-tension lines by means of this safety suspension has been permitted by the German Imperial Post Office Department and also by the Minister of Public Works.—*Abstracted from Elektrotechnische Zeitschrift, Berlin, September 23, 1909.*



Industrial Power

INSTALLATION, OPERATION, CARE AND REPAIR OF ELECTRIC MOTORS IN INDUSTRIAL OPERATIONS.—III.

BY C. E. DANIELS.

GENERAL INSTRUCTIONS FOR ALTERNATING-CURRENT MOTORS.

Alternating-current induction motors are of the single-phase and polyphase (two-phase and three-phase) types. Single-phase motors are operated on circuits fed by single-phase generators or on the individual phases of polyphase circuits. In the latter case the total motor capacity should be evenly distributed among the several phases, so as to keep the polyphase circuit balanced. A single-phase motor must necessarily have some automatic feature in order to be self-starting, and consequently is more complicated than either a direct-current motor or a polyphase induction motor. However, single-phase motors are now available which are automatically self-starting with load and with no starting devices other than line switches, and which at the same time will run for long periods with almost no trouble nor expense for repairs.

Two-phase induction motors are operated on two-phase four-wire circuits or on two-phase three-wire circuits, both of which can be fed by two-phase generators or by three-phase generators with phase-changing transformers. Transformers may, of course, intervene between the generators and the motors in either case. Two-phase motors should not be operated on two phases of three-phase circuits, except in emergencies. Two-phase three-wire circuits are seldom used on account of liability to unbalancing.

Three-phase motors are operated on circuits fed by three-phase generators, with or without intervening transformers. Three-phase motors should not be operated on two-phase three-wire circuits except in emergencies. In either of the emergency cases just mentioned the efficiencies of the motors are reduced thirty or forty per cent.

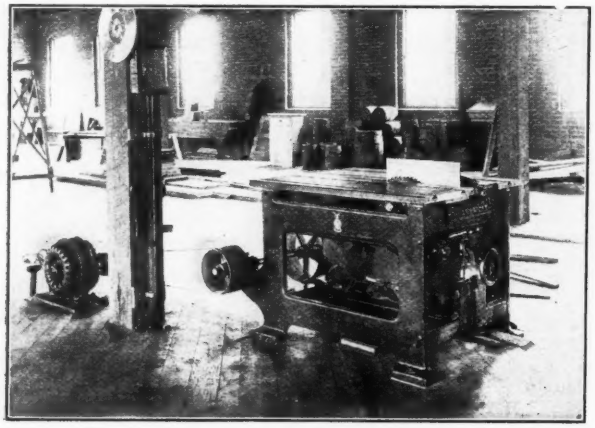


FIG. 14.—1,500-HORSEPOWER VERTICAL MOTOR OPERATING CENTRIFUGAL PUMP.

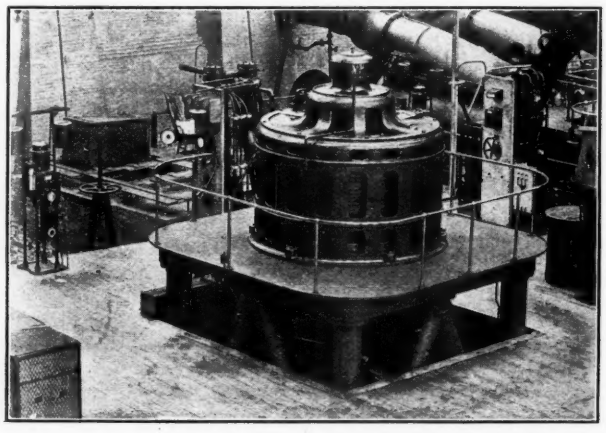


FIG. 15.—FLOOR-MOUNTED ALTERNATING-CURRENT MOTOR BELTED TO COMBINATION SAW.

All polyphase induction motors, whether two-phase or three-phase, are of two general classes, according to the rotor windings, namely, those having squirrel-cage rotors and those having phase-wound rotors with slip rings. Almost all polyphase induction motors of either class below five horsepower in size can be started by switching them directly on to the circuit with an ordinary knife switch. Fuses should be installed on the line-circuit side of the switch for overload protection.

Squirrel-cage motors larger than five-horsepower capacity should have at least one step of reduced voltage for starting. One step is usually enough, and it is best obtained by means of auto-starters or compensators. These devices consist of auto-transformers, usually two in each case, and switching devices. The switch is so arranged that its first movement connects the auto-transformers to the line and simultaneously connects two phases of the motor primary across portions of the auto-transformers; the second movement disconnects the auto-transformers and simultaneously connects the motor primary to the line.

The starting voltage applied to a squirrel-cage motor should be high enough for the starting torque, but not much in excess. If the voltage is greater than is required, the motor starts too suddenly and the starting current is too high. In such a case the maximum starting current, taken at the instant the starting voltage is applied, depends only on the voltage. This current decreases very promptly to a value proportional to the torque and then continues to decrease more slowly as the speed increases and the required torque decreases. For most practical purposes a starting voltage of sixty-five per cent of the line voltage is enough; but provision is usually made in the starting device for making the starting voltage higher or lower, according to the requirements.

Slip-ring motors larger than five-horsepower capacity are started by first closing the secondary circuit through a resistance

and then cutting out this resistance in steps, the process being much the same as in starting direct-current motors. The greater the resistance in the secondary circuit of an induction motor, the greater the slip; hence, the speed of slip-ring motors can be readily controlled by means of variable resistance. This method of speed control gives the same inherent speed regulation as direct-current motors with resistance in the armature circuits, namely, varying speed with varying load. Starters and controllers for slip-ring induction motors are simply rheostatic in principle, although they may assume various forms.

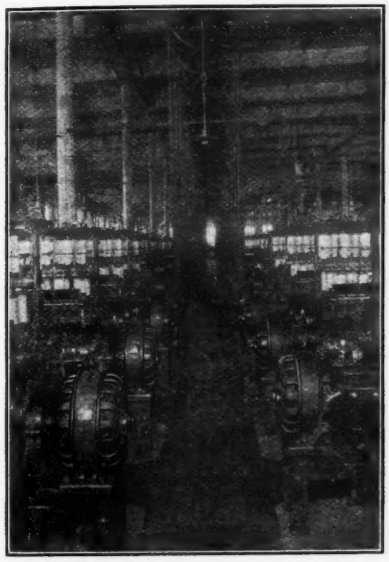


FIG. 16.—ALTERNATING-CURRENT MOTORS DRIVING SPINNING FRAMES.

Reversing.—The method of reversing a single-phase motor depends so much on the design of the motor that no general instructions can be given. To reverse the direction of rotation of a two-phase four-wire motor, the two leads of either phase are interchanged, and on a two-phase three-wire motor the two outside wires are interchanged. To reverse a three-phase motor, the two leads of any phase are interchanged. These changes can be made at the motor terminals, or by a reversing switch at any convenient location.

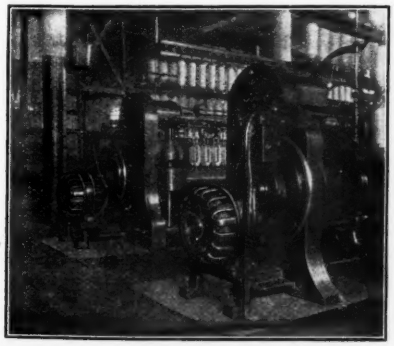


FIG. 18.—ALTERNATING-CURRENT MOTORS DIRECT-CONNECTED TO WOON-SOCKET SPEEDERS.

Voltage and Frequency.—For best results, induction motors should be operated at their normal voltage and frequency. Some variation, however, is almost always allowable, the usual limits specified by most manufacturers being about ten per cent either way from normal. The voltage and frequency should never be varied simultaneously in opposite directions, and ordinarily both should not be varied at the same time to the extreme limits given. With any variation of either the voltage or the frequency from normal conditions the following changes from normal operating characteristics must be expected:

	Power-Factor.	Torque.	Slip.	Full-Load Efficiency.
Voltage high	Dec.	Inc.	Dec.	Approx. same
Voltage low	Inc.	Dec.	Inc.	Approx. same
Frequency high	Inc.	Dec.	Inc.	Approx. same
Frequency low	Dec.	Inc.	Inc.	Approx. same

In general, any change from normal frequency should be accompanied by a change of voltage proportional to the square root of the frequency. For example, a 400-volt sixty-cycle motor on 66 2/3 cycles will give very nearly normal operating characteristics if the voltage is made 422 volts ($=400\times\sqrt{66\ 2/3\div 60}$).

For decreased frequency, however, it is not recommended that motors be operated on less than normal voltage on account of increased current and temperature. The application of the foregoing rule for higher than normal frequency gives on the contrary reduced temperature rise.

Power-Factor.—The actual power in watts taken from the supply circuit by a motor, if measured by a wattmeter, is less than the product of the volts and amperes measured independently. The ratio of the wattmeter reading to the volt-amperes measured independently is the power-factor. Low power-factors are undesirable, as they indicate considerable idle, or wattless, current in the generators, lines and transformers, resulting in unnecessary heating.

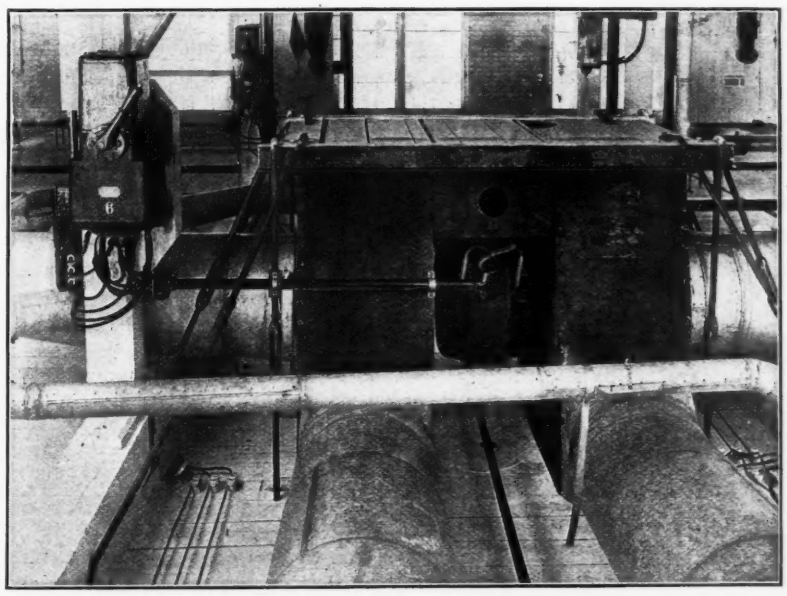


FIG. 17.—ALTERNATING-CURRENT MOTOR DIRECT-CONNECTED TO BLOWERS FOR DUST AND SHAVINGS CONVEYOR.

Slip.—At no load an induction motor runs at practically synchronous speed; with a load the motor speed is below synchronous speed by a percentage known as the slip. That is, if the synchronous speed is 1,800 revolutions per minute and the full-load speed 1,700 revolutions, the slip at full load is 5.5 per cent. The slip of any induction motor depends on the voltage drop in the secondary cir-

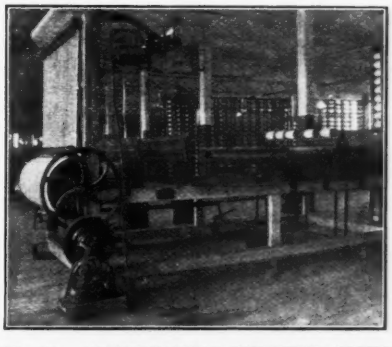


FIG. 19.—ALTERNATING-CURRENT MOTOR DIRECT-CONNECTED TO WARPER IN TEXTILE MILL.

cuit, *i. e.*, on the product of the secondary resistance and current. The greater the secondary resistance, the higher the starting torque with a given current, the greater the slip, and the greater also are the losses and the lower the efficiency.

Efficiency.—The losses in an induction motor are: (1) Primary iron loss—constant at all loads if the electromotive-force is constant. (2) Primary copper loss, consisting of an approximately constant loss, due to the wattless magnetizing current and a loss varying with the square of the load. (3) Secondary copper loss, which corresponds to the percentage slip, *i. e.*, if the slip is 5.5 per cent, the secondary copper loss is the same. (4) Other losses, consisting of secondary iron loss, which is usually very small, and friction of bearings and air.

[To be continued.]

Curing Ham by Electricity.

Ham curing by electricity was discussed by the American Meat Packers' Association, on October 18 last, at its third annual convention at the Hotel La Salle and was declared to be practicable. The idea of applying the cure to meat originated in Ohio and is said to have been in practical operation for over three years on a small scale as a commercial process. The electric curing was hailed as a possible means of reducing the cost of making ham and bacon.

The most remarkable thing about electrically cured meat was said to be its keeping qualities, J. C. Lincoln, of Cleveland, declaring in a paper that:

"Two or three years ago, as an experiment, several pieces of electric-cured bacon were put into an open box, protected by wire netting, about one-half-inch mesh, to keep out mice and rats, but large enough to allow insects to enter, and shipped to Vera Cruz, Mexico. This point was selected particularly because Vera Cruz is about as hot and damp as any point in the Western hemisphere. The meat, of course, was inspected by the government inspector before shipment, and inspected by him upon its return to Cincinnati, and pronounced perfect. In fact, a piece of this same bacon is on exhibition. It is three-and-one-half years old and shows no sign of decomposition."

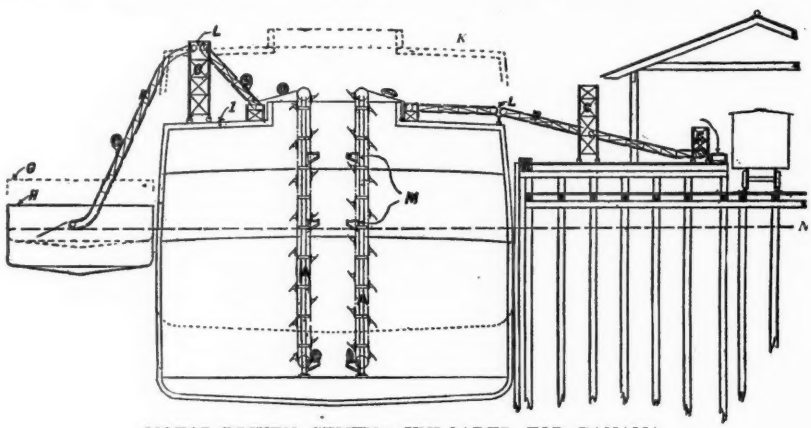
The method employed in an electric curing is only slightly different from the ordinary curing process. The meat is placed in large vats, filled with a pickle of sugar, salt and saltpeter, and an electric current is then passed through.

A Motor-Driven Cement Unloader.

The Panama Railroad Company has recently contracted for a motor-driven cement unloader to be installed at Cristobal, Canal Zone, to facilitate the unloading of cement from the ships arriving at that port. There are about 4,000,000 barrels, or over 800 tons, of cement yet to be imported at Cristobal, for use in constructing the Panama Canal locks and for other work.

The vessels employed in the cement-carrying business in this connection are the twin steamships *Ancon* and *Cristobal*, each of 10,000 tons capacity, the cargoes being usually divided about equally between cement and general freight. Each ship makes one round trip a month between New York and Cristobal.

The following description of the unloader, and the accompanying diagram, are taken from a recent issue of *The Canal Record*, which is published weekly at Ancon, C. Z.



MOTOR-DRIVEN CEMENT UNLOADER FOR PANAMA.

The diagram shows the arrangement of a conveyor unit for bags and one for barrels. The unit for bags is composed of three parts: (1) A vertical elevator (*A*, in illustration) for raising the bags of cement from the hold to the deck of the ship, consisting of a vertical shaft on which revolves an endless chain of brackets; (2) a portable apron conveyor (*B*) at right angles to the ship, built in sections twenty feet long, which conveys the bags from the deck of the ship to the pier, and which has two towers (*C*) for adjusting the aprons as the vessel lightens and rises in being unloaded, there being a difference of twelve feet between loaded and empty drafts; (3) a stationary apron conveyor (*F*), built lengthwise on the pier, which delivers the bags to any point along the railroad track.

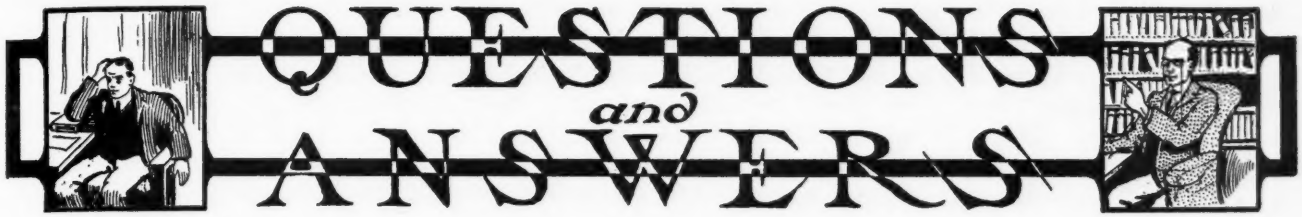
The conveyor unit for barrels is composed of two parts: (1) A vertical elevator, the same as in the unit for bags; (2) a barrel lowerer (*E*), with an adjusting tower, which conveys the barrel of cement from the deck of the ship into the hold of the barge alongside. In the diagram, (*G*) shows the position of the barge when empty, (*H*) when it is loaded; (*I*) and (*K*) the positions of the ship when loaded and empty, respectively; (*L*) is a universal joint and coupling; (*M*), the loading stationary brackets, and (*N*) the surface of the water.

Hand labor will be required at three points only with the conveyor system, viz., in placing the bags, or barrels of cement in position on stationary brackets, located on each of the three decks of the hold, so that the brackets on the vertical elevator can raise them; on the pier, in transferring the bags from the stationary conveyor to the freight cars, and in the hold of the barge, in removing the barrels from the lowerer and stowing them away.

Each vertical elevator in the conveyor system will be operated by a ten-horsepower electric motor, each barrel lowerer by a five-horsepower motor, each complete portable apron conveyor by a three-horsepower motor, and each section of the stationary apron conveyor on the pier by a 7.5-horsepower motor, making a total of 20.5 horsepower for each bag conveyor unit, and fifteen horsepower for each barrel conveyor unit. All motors will be totally enclosed and will be dust and moistureproof. Electricity for the motors will be supplied from the power house of the Gatun handling plant.

It is expected that one complete unit of the conveyor system will be in operation by December 1, and that at least two units a month will be completed and in operation thereafter until finished.

The contract for the unloader was awarded to the Alvey-Ferguson Company, of Louisville, Ky.



POWER ON THREE-PHASE CIRCUITS WITH UNITY POWER-FACTOR.—(1) If a three-phase circuit having unity power-factor and Δ connection has placed an ammeter in one of the mains and a voltmeter between two of the three wires, does the product of the volts and amperes give the watts on the corresponding phase, or is this product to be multiplied by $\sqrt{3}$? (2) With a four-wire Y-connected three-phase circuit and a voltmeter connected between one of the three main wires and the neutral wire and the ammeter in one of the three mains, does the product of the volts and amperes and $\sqrt{3}$ give the watts on that phase? (3) If a voltmeter were connected between two of the main wires, what would the watts be?—G. W. H., Bismarck, N. D.

In all these answers it is assumed that power factor is unity. In case (1) the product of volts and amperes divided by $\sqrt{3}$ gives the watts consumed in one phase of the receiving circuit. With a four-wire Y-connected circuit, in case (2), the product of the volts and amperes will give the watts on any phase between neutral and one of the main wires. In case (3), with a similar circuit and a voltmeter connected between two of the three main wires, the watts taken by the circuit connected between these two wires would equal the product of the volts and amperes divided by $\sqrt{3}$. Assuming the circuits to be completely balanced, the total power received in the latter case would equal the product of the current in any of the main wires multiplied by the voltage between two of them and by the $\sqrt{3}$, that is, it is three times the power consumed in each phase. In case the power-factor is not unity, then in each of the cases cited, the products must be further multiplied by the value of the power-factor.

REVERSING MOTOR.—Recently, while running our generator with a forty-horse-power gasoline engine, we left it for about two hours, everything being in good running order. On coming back we found everything running all right, but one of our customers claims that his motor started to run backward in the meantime. We feel sure that our engine never came to a dead stop, or else it would not have been running on our return. It might have missed and slowed down and then picked up again. What could have caused the motor to run backward? On shutting down the power and starting up again the motor ran in the proper direction.—J. H. S., Elgin, Ill.

The only thing that could have made the motor reverse, if it was a direct-current shunt, series or compound motor, or an alternating-current motor, would be a reversal of either the field or armature circuit, or one of the phases. This means that someone must have tampered with the machine or intentionally reversed it in the manner referred to. The stoppage of the engine should have had no result other than stopping the motor. Even if the engine had been reversed so that the polarity of the generator was changed, it would have reversed the current in both the field and armature circuits of the motor, which does not reverse its direction of rotation.

ELECTROLYSIS OF WATER - SERVICE PIPES.—We are having trouble with electrolysis on the cross-service pipes where they pass under the electric-railway tracks. It has occurred to me to connect these service pipes to the rails and thereby form a direct metallic path for the current, but I am not able to tell what effect this might have on the large water mains nor whether it will overcome the trouble. Kindly give me some information on this subject.—W. D. E., West Milton, Ohio.

The subject of electrolysis of underground pipes and cables has been studied quite extensively, and the causes therefor and the most effective remedies are generally quite well known. The exact remedy to be applied in every instance depends somewhat, however, upon the topography of the town and the layout of both the underground systems and the railway tracks, as well as the location of the power houses. It is well known that if the underground piping or cable systems afford a better or more direct path for the return trolley current to the power house the current will leave the rails and follow the underground path. The mere passage of a current through any pipe or lead cable does not deteriorate it whatever, but if this path is discontinuous, as, for instance, at joints in piping where current passes through the ground around the joint, it is found that where the current has left the pipe, corrosion is noticeable. Similarly in the neighborhood of the power house, where the current leaves the underground piping to return to the negative side of the generator circuit, the corrosion is apt to be very marked. The general remedy for elimination of electrolytic corrosion is: (1) To thoroughly bond the rails of the traction system so as to make them a perfect return path for the current; (2) to connect any underground piping or other metallic structures in the neighborhood of the power house by means of heavy copper cables with the negative busbar in the power house. The latter provision is so as to insure that any current which may have entered the underground pipes may reach the negative side of the circuit. In the particular instance of corrosion noticed on the cross-service pipes where they pass under the railway tracks it is probable that at some remote point the current has entered the piping system and is leaving it to return to the tracks at the point in question. Therefore, the connection of the pipes at this point with the tracks should be of considerable value, at any rate in stopping the corrosion at that point. Without an exact knowledge of the layout of the piping and railway system, it is impossible to say whether such a connection may not bring about trouble at some other point, by affording a better path for current to follow.

INSULATION OF PLIERS.—How can I insulate a pair of pliers with hard rubber or mica?—L. J. M., Chicago.

If the pliers are provided with straight handles it may be a comparatively simple matter to slip a piece of hard-rubber tubing upon the handles and tape them in place. If the handle is curved or of odd shape, it will be necessary to provide a specially shaped piece of hard rubber to fit, or to mold rubber upon the handle and then vulcanize it. Ordinary mica sheets cannot very easily be applied to handles of pliers on account of the difficulty of keeping them in place. There is obtainable in the market now a grade of pulverized mica which can be combined with a cement and applied to the pliers so as to form a fairly thick and durable coating.

Statement of the New York, New Haven & Hartford Railroad Company.

The general statement of the affairs of the New York, New Haven & Hartford Railroad Company for the thirty-eighth fiscal year ended June 30, 1909, has recently been issued.

In accordance with the by-laws of the company, the board of directors have caused to be prepared a statement of its affairs as follows:

FOR TWELVE MONTHS, JULY 1, 1908, TO JUNE 30, 1909, INCLUSIVE.

Operating revenue:		
Freight revenue	$26,595,969.67	
Passenger revenue	22,852,741.77	
All other revenue from transportation	3,713,867.46	
Revenue from operations other than transportation	1,185,052.07	
Total operating revenue		$54,347,630.97
Operating expenses:		
Maintenance of way and structures	$ 6,130,606.46	
Maintenance of equipment	5,906,356.68	
Traffic expenses	308,999.73	
Transportation expenses	22,491,376.16	
General expenses	1,242,967.51	
*Total operating expenses		36,080,306.54
Net operating revenue		$18,267,324.43
Net revenue from outside operations	$ 1,214,306.52	
Net earnings, The Connecticut Co.	3,644,314.86	
Total		4,858,621.38
Total net revenue		$23,125,945.81
Taxes		3,446,125.98
		$19,679,819.83
Income from other sources:		
Dividends on stocks	$ 1,959,333.14	
Interest on bonds	674,432.55	
Miscellaneous income	1,609,581.25	
Rents received	350,141.94	
Total income from other sources		4,593,488.88
Total income		$24,273,308.71
Deductions from income:		
Interest on bonds, debentures and other liabilities	$10,424,931.76	
Rentals and leased lines	3,956,293.81	
Rentals other than above	1,978,281.31	
Hire of equipment	460,430.13	
Miscellaneous	23,142.72	
Total deductions from income		16,843,079.73
Net income		$ 7,430,228.98
Dividends Nos. 116 to 119, inclusive, 2 per cent each		7,883,842.00
Deficit		$ 453,613.02

*The operating expenses and taxes were 72.73 per cent of the total operating revenue.

The six-track construction of the Harlem River & Port Chester Railroad has been continued, and ninety per cent of the total work has been completed. The installation of an automatic signal system is now under way, and will be completed on or about January 1, 1910.

The electrification of the New Canaan branch has been completed, and trains have been operating electrically over this branch during the past year. Work is now in progress at Glenbrook, Conn., on the erection of approximately one mile of four and six-track catenary construction, beginning at the easterly terminus of the present overhead construction, a short distance east of Stamford. Contract has been awarded for two electric freight locomotives. This work is for experimental purposes to determine future standards in connection with a proposed extension of our electric service.

By a decree of the Supreme Judicial Court of the Commonwealth of Massachusetts of May, 1908, in the suit of the Attorney-General against the New York, New Haven & Hartford Railroad Company, the company was enjoined from holding directly or indirectly the stock of any Massachusetts street railway after July 1, 1909. In consequence of this decree it became necessary to sell the stocks and indebtedness of the Worcester & Webster Street Railway Company and of the Webster & Dudley Street Railway Company, which came into the treasury of your company through the merger with the Consolidated Railway Company of May 31, 1907, thus closing out the last financial interest of the company in Massachusetts street railways. The only interest not eliminated is the indorsement upon the shares of the Springfield Railway Companies and the New England Investment and Security Company. These indorsements under decrees of the courts thus far rendered, we must apparently continue until the liquidation of the trusts they represent, but the earnings of the properties owned by both trusts seem to be ample to enable them to meet all obligations without calling upon the company to make any payments under the terms of its guaranty. The obligation may therefore be considered more a nominal than a material one.

By reason of the substitution of electric motive power for steam within the limits of the city of New York, required by law, and the need for larger facilities at the Grand Central Terminal, involving the expenditure of a large amount of money, it was deemed advisable to join with the New York Central & Hudson River Railroad Company in a new agreement for the use and occupancy of the terminal. This agreement is now in effect, and, while it entails an additional expense to the company for its use of the terminal, it is recognized as a natural sequence to legal requirements and the changed conditions.

The General Court of the commonwealth of Massachusetts, at its 1909 session, authorized the incorporation of the Boston Railroad Holding Company for the sole purpose of acquiring and holding the whole or any part of the capital stock, bonds and other evidences of indebtedness of the Boston & Maine Railroad and of voting on all certificates of stock so acquired and held, and of receiving and collecting dividends and interest upon said stock, bonds and other evidences of indebtedness.

Under the authority of this act the Boston Railroad Holding Company has organized and entered into contracts for the purchase of the large block of Boston & Maine Railroad stock representing a substantial control of the outstanding stock of that company, which was formerly acquired in the interest of the New York, New Haven & Hartford, and the directors have entered into agreements to purchase all the stock and bonds of the Boston Railroad Holding Company that will be issued for payment of the same.

The result of this transaction will be to give the company an indirect control of a stock interest in the Boston & Maine Railroad through the ownership of all the outstanding capital of the Boston Railroad Holding Company.

This very satisfactory conclusion of the controversies which grew out of the purchase by the New England Navigation Company of a large stock interest in the Boston & Maine Railroad about two years ago, is anticipated by the directors to be of large advantage to the company in the building up of a distinctively New England Railroad system devoted to the interests of that section, securing more advantageous arrangements with connecting lines and a more economical administration of the properties when run in a common interest than has resulted heretofore. Much will have to be done before the estimated results will be realized, but that immediate improvement in the business of both companies will result is confidently anticipated.

Telephone Opportunities in Latin America.

A report has been received from an American legation in a Latin-American country stating that a local telephone company has been authorized to construct a local and long-distance telephone system, connecting all important points in the country. Particulars about the decree can be obtained by interested firms upon application to File No. 3995, at the Bureau of Manufactures, Washington, D. C.

FINANCIAL REPORTS OF ELECTRICAL COMPANIES.

LAKE SHORE ELECTRIC.

The report of the Lake Shore Electric Railroad Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$108,206	$104,072
Expenses and taxes	49,842	49,648
September net	$ 58,364	$ 54,424
Interest	34,804	34,012
September surplus	$ 23,560	$ 20,412
Nine months gross	835,061	787,209
Expenses and taxes	439,691	439,497
Nine months net	$395,370	$347,711
Interest	309,093	287,719
Nine months surplus	$ 86,277	$ 59,992

YONKERS RAILROAD.

The New York Public Service Commission has issued a report covering the operations of the Yonkers Railroad Company for the year ended June 30, 1909, as follows:

Operating revenue	$487,552
Operating expenses	489,241
Net deficit	$ 1,689
Taxes accrued	25,751
Operating deficit	$ 27,440
Other income	509
Total deficit	$ 26,931
Interest charges	52,737
Net corporate deficit	$ 79,668
Previous deficit (company's books)	344,827
Previous deficit (receiver's books)	16,269
Deficit, June 30, 1909	$440,764

BIRMINGHAM RAILWAY, LIGHT AND POWER.

The report of the Birmingham Railway, Light and Power Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$ 188,364	$ 177,388
Expenses	105,753	107,566
September net	$ 82,611	$ 69,822
Nine months gross	1,646,825	1,581,763
Expenses	917,679	928,148
Nine months net	$ 729,146	$ 653,615

TWIN CITY RAPID TRANSIT.

The report of the Twin City Rapid Transit Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$ 645,197	$ 583,876
Expenses	270,035	276,588
September net	$ 375,162	$ 307,287
Charges, taxes and preferred dividends	140,250	138,666
September surplus	$ 234,911	$ 168,621
Nine months gross	5,176,419	4,765,801
Expenses	2,432,567	2,372,024
Nine months net	$2,743,852	$2,393,776
Charges, taxes and preferred dividends	1,248,510	1,145,122
Surplus	$1,495,342	$1,248,654

JAMESTOWN STREET RAILWAY.

The report of the Jamestown (N. Y.) Street Railway Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total operating revenue	$ 52,194	$ 45,589
Total operating expenses	28,503	28,939
Net operating revenue	$ 23,690	$ 16,650
Taxes accrued	1,454	1,403
Gross income	$ 22,236	$ 15,246
Total deduction from gross income	15,956	14,729
Net corporate income	$ 6,280	$ 517

BINGHAMTON RAILWAY COMPANY.

The report of the Binghamton (N. Y.) Railway Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total operating revenue	$ 84,837	$ 80,255
Total operating expenses and taxes	55,898	46,944
Net	$ 28,939	$ 33,311
Charges	23,040	23,396
Surplus	$ 5,899	$ 9,914

PACIFIC TELEPHONE AND TELEGRAPH.

The report of the Pacific Telephone and Telegraph Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$1,045,832	.....
Expenses	724,600	.....
September net	$ 321,232	.....
Interest charges	104,051	.....
September surplus	$ 217,181	.....
Nine months gross	9,002,289	$7,738,528
Expenses	6,293,153	5,727,001
Nine months net	$2,709,135	$2,011,527
Interest charges	946,920	754,742
Nine months surplus	$1,762,216	$1,256,785

DETROIT UNITED RAILWAY COMPANY.

The report of the Detroit United Railway Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$ 751,818	$ 668,489
Expenses	477,850	423,136
September net	$ 273,968	$ 245,353
Other income	11,762	5,028
Total income	$ 285,730	$ 250,381
Charges, taxes, etc.	158,124	135,049
September surplus	$ 127,606	$ 115,332
Nine months gross	5,963,431	5,324,855
Expenses and taxes	3,702,532	3,395,252
Nine months net	$2,260,899	$1,929,603
Other income	108,205	45,055
Total income	$2,369,104	$1,974,658
Charges, taxes, etc.	1,409,507	1,218,860
Nine months surplus	$ 959,597	$ 755,798

PACIFIC TELEPHONE AND TELEGRAPH.

For the nine months ended September 30, the net earnings of the Pacific Telephone and Telegraph Company show an increase of $697,609 over the corresponding period of 1908. The net earnings were $2,709,136. The gross earnings for the nine months were $9,002,289, with expenses of $6,293,153, an increase in expenses of $566,152 over last year. The surplus is placed at $1,762,216, showing an increase of $505,431.

There has been a steady increase in earnings during the nine months. At the end of the fiscal year 1908 there was a balance of $559,327 available for dividends on the common stock, or 3.1 per cent on the $18,000,000 outstanding, after deducting $1,080,000 payable in dividends on the preferred.

The surplus available for common dividends at the end of nine months was at the rate of seven per cent per annum, but the net earnings for August alone were at the rate of almost eleven per cent on the common stock, and it was this increase that probably gave rise to the report that a dividend would be declared, which report was declared without foundation by President Scott.

Preferred dividend requirements for the nine months ended September were $952,216.

AMERICAN CITIES RAILWAY AND LIGHT.

The American Cities Railway and Light Company reports the combined earnings of its operating companies, for the month of September and nine months ended September 30, 1909, compared as follows:

	1909.	1908.
September gross	$ 488,795	$ 458,218
Expenses and taxes	287,470	276,210
September net	$ 201,324	$ 182,007
Interest and sinking fund	106,724	105,456
Surplus	$ 94,601	$ 76,551
American Cities proportion of surplus on basis of stock ownership	$ 83,661	$ 67,654
American Cities preferred dividend	34,530	34,530
Balance applicable to stock and reserves	$ 49,131	$ 33,124
Equivalent on American Cities outstanding stock to	5.48%	3.69%
Nine months gross	$4,226,102	$3,987,293
Expenses and taxes	2,454,247	2,407,989
Nine months net	$1,771,855	$1,579,304
Interest on sinking fund	956,361	938,225
Surplus	$ 815,493	$ 641,079
American Cities proportion of surplus on basis stock	720.640	561,623
American Cities preferred dividend	310,774	310,774
Balance applicable to stock and reserves	$ 409,865	$ 250,848
Equivalent on American Cities outstanding common stock to	5.08%	3.10%

SYRACUSE & SUBURBAN.

The report of the Syracuse & Suburban Railroad Company for the quarter ended June 30, 1909, compares as follows:

	1909.	1908.
Total operating revenues	$30,599	$30,209
Total operating and taxes	24,062	14,964
Net operating revenues	$ 6,536	$15,244
Other income	83	406
Gross income	$ 6,620	$15,651
Total deductions from gross inc.	7.235	7.309
Net corporate income	*$ 614	$ 8,341

*Deficit.

DRY DOCK, EAST BROADWAY & BATTERY.

The New York Public Service Commission has issued a report covering operations of the Dry Dock, East Broadway &

Battery Railroad Company, receiver for the year ended June 30, 1909, as follows:

Total operating revenue	$629,680
Operating expenses	444,729
Net operating revenue	$184,950
Taxes accrued	25,613
Operating income	$159,337
Interest charges	66,930
Net corporate income	$ 92,407
Previous surplus	14,227
Additions, adjustments, prior period	13,836
Total surplus	$120,470
Taxes prior period	2,079
Surplus June 30, 1909	$118,391

TOLEDO RAILWAYS AND LIGHT.

The report of the Toledo Railways and Light Company for the month of September and nine months ended September 30 compares as follows:

	1909.	1908.
September gross	$ 217,737	$ 222,892
Expenses	121,779	111,900
September net	$ 95,958	$ 110,992
Other income	358	61
Total income	$ 96,316	$ 111,053
Charges and taxes	75,483	71,976
September surplus	$ 20,833	$ 39,077
Nine months gross	1,981,435	1,864,822
Expenses	1,134,049	1,019,823
Nine months net	$ 847,386	$ 844,999
Other income	2,198	3,072
Total income	$ 849,584	$ 848,071
Charges and taxes	652,202	635,743
Nine months surplus	$ 197,382	$ 212,328

AMERICAN LIGHT AND TRACTION.

The American Light and Traction Company's surplus and earnings account, for the twelve months ended September 30, 1909, compares as follows:

	1909.	1908.
Net earnings (12 months)	$3,089,190	$2,579,266
Preferred dividend	854,172	854,172
Common dividend	740,353	446,886
Common dividend stock	1,056,010	.....
Balance	$ 438,655	$1,278,208
Previous surplus and construction reserve	4,992,027	3,905,819
Bal. surplus, Sept. 30, '09.	*$5,430,682	$5,184,027

*Includes reconstruction reserve fund, which amounted to $2,355,000 on September 30, 1909.

NORTHWESTERN ELEVATED.

The Northwestern Elevated Railroad Company's report for the year ended June 30, 1909, compares as follows:

	1909.	1908.
Gross	$2,540,883	$2,463,188
Expenses	995,818	965,118
Net	$1,545,064	$1,498,070
Charges, taxes, etc.	1,189,288	1,147,183
Surplus	$ 355,776	$ 350,887
Earnings on $5,000,000 preferred stock, per cent	7.1	7.0

The earnings, expense in detail and the principal statistics compare as follows:

GROSS EARNINGS.

	1909.	1908.
Main line	$1,913,515	$1,857,553
Other earnings, including loop dividends	627,368	605,434
Total	$2,540,883	$2,463,187

OPERATING EXPENSES.

Maintenance of way	$ 45,037	$ 40,114
Maintenance of equipment	147,045	130,381
Transportation	699,843	693,759
General and legal	103,893	100,861
Total	$ 995,818	$ 965,116
Passengers carried		37,419,286
Daily average		102,238

The Northwestern Elevated's daily average passengers were 112,207, or 9.75 per cent increase. President Starring says the worst of the competition from traction rehabilitation has passed. Increased expenses were caused by opening new lines and higher taxes and one costly accident, also a more liberal maintenance. Evanston line territory is developing rapidly. The company has received from the Central Trust Company, New York, $334,000 first-mortgage bonds of the Union Elevated Railroad Company, which are now in this company's treasury. Stocks of Chicago & Oak Park Elevated Railway Company, obtained pursuant to plan of reorganization, and the Lake Street Elevated Railroad Company have recently been delivered to this company and are included in item "stocks and bonds." Company's floating debt was reduced by proceeds of sale of $3,000,000 bonds heretofore authorized, which have been sold and delivered.

It is the expectation of the management that the earnings will warrant a continuance of dividends upon the preferred stock, and that the maximum rate provided therefore will be ultimately attained.

THIRD AVENUE SURPLUS $1,265,132.

The New York Public Service Commission has given out the reports of the companies in the Third Avenue Railroad system for the fiscal year ended June 30, 1909. The reports showed surplus on the entire system after payment of operating expenses, taxes, and of the $769,157 interest charges still in force, of $1,265,132.

This is reached without providing for either the old rental on the Third Avenue stock or the interest on its $37,560,000 of general mortgage bonds, which are in default. The figure compares closely with the estimates submitted to the Public Service Commission when the reorganization plan now turned down was before the commission last June.

The gross earnings on the Third Avenue system were $6,975,362, and its net income, after deducting operating expenses and taxes and taking in miscellaneous income, $2,034,278. Interest charges amounted to $769,157, and after miscellaneous and other charges and allowances of a minor nature, the surplus stood at $1,265,132 for the year.

At present the Third Avenue Road proper reports a total surplus of $885,525, the Dry Dock Road a surplus of $118,390, the Forty-second Street, Manhattanville & St. Nicholas Avenue Road a surplus of $373,693, and the Union Railway a surplus of $360,687—these surpluses making no allowance for securities in default. The Southern Boulevard Company has a deficit of $79,371, the Yonkers Railway a deficit of $440,764, and the Westchester Electric Railway a deficit of $738,448.

GENERAL ELECTRIC.

Gross sales of General Electric for October will show a total of slightly less than $4,750,000, or at the rate of $57,000,000 per annum, which is the highest ratio of sales for any single month since the current fiscal year began February 1. General Electric sales have shown a decidedly creeping tendency for the past few months. There has been a slight gain, but the big jumps that came in the earlier months of the spring are not now being recorded. In fact, for the last four months the increase in new orders booked has not been over three per cent. For the full fiscal nine months, however, the gain has been thirty-five per cent.

The General Electric Company continues to show an improvement in business and its orders are running about eighty-five per cent of what they were in the best year since the company was organized. Although sharp competition has narrowed the margin of profit on certain electrical apparatus, the showing of the company for the current fiscal year will be much more favorable than in the preceding year. A substantial surplus after the payment of the eight per cent dividend will be shown.

The General Electric Company has been spending millions of dollars for the purpose of remodeling and systematizing its plants, and the result has been a very material reduction of operating costs. Besides, the company has under construction work that will add several hundred thousand square feet to its floor space.

MASSACHUSETTS ELECTRIC COMPANIES.

The Massachusetts Electric Companies has issued its statement for the quarter ended September 30, 1909. It compares as follows:

	1909.	1908.
Gross	$2,626,388	$2,483,710
Expenses	1,289,727	1,341,817
Net	$1,336,661	$1,141,893
Charges and taxes	432,058	417,493
Surplus	$ 904,603	$ 724,400

The Massachusetts Electric Companies' fiscal year ends September 30. The following are the figures for the twelve months ending September 30, compared with those for the preceding year:

	1909.	1908.
Gross	$8,052,355	$7,809,010
Expenses	5,148,396	5,001,517
Net	$2,903,958	$2,807,492
Charges and taxes	1,778,129	1,784,437
Surplus	$1,125,829	$1,023,054

AMONG THE CONTRACTORS AND SUPPLY MEN

To know what is going on among the men who do things and those who supply the material for the doing is always interesting. "Actualities," the actual happenings of the day with the contractors and the men who furnish them with supplies of all kinds, accurately reported from all parts of the country, is the object of this department.

HOLMES BROS., Indianapolis, Ind., have been awarded a contract for the installation of a new electric-light plant at Pendleton, Ind. S.

THE WESTINGHOUSE ELECTRIC COMPANY, Pittsburg, Pa., has secured the contract for the electrical equipment of the electric-light plant at Bear Creek, Mont., from N. S. Poole. Work on construction will be commenced at once.

THE BATES MACHINE COMPANY, Joliet, Ill., has secured the contract for the installation of a Corliss heavy-duty engine, sixty-six by thirty-six, at Le Sueur, Minn.

THE MINNEAPOLIS ELECTRIC MOTOR COMPANY, Minneapolis, Minn., has secured the contracts for the following: Jonas F. Brown & Co., building at 19 Washington Avenue North, wiring and furnishing a complete line of Tungstolier fixtures; T. H. Bastian, building corner Eighth and Hennepin, wiring for offices on second floor; Crystal Theater; Greek Church, Tenth Avenue South and Lake Street; all in Minneapolis.

THE NASHWAUK ELECTRICAL COMPANY, Duluth, Minn., has secured the contract for wiring the houses recently erected by the Oliver Iron Mining Company at its new mine, the Mississippi, near Keewatin. The Oliver Iron Mining Company has eleven houses completed at the new location and more are under course of construction.

W. S. BARSTOW & COMPANY, New York, N. Y., reports the building of a transmission and distributing system for the Delaware County Electric Company in Delaware County, Pa. The contract amounts to about $200,000 and will be expended entirely upon pole line, substations and such equipment. The current for the company will be purchased from the Philadelphia Electric Company. This work is well in hand, but there is considerable material yet to be purchased.

THE MIDLAND ELECTRIC COMPANY, Des Moines, Ia., was recently awarded the contract for wiring the Merchants' Transfer Building.

THE DES MOINES ELECTRIC CONTRACTING COMPANY, Des Moines, Ia., has been awarded the contracts for wiring the Methodist Hospital and installing a special signal service system throughout the entire building. The same firm has also secured the contract to do all of the electrical work in the new Des Moines Edison intake.

R. WILLIAMSON & COMPANY, Chicago, Ill., have been successful in their bid for installing light fixtures at Cape Girardeau, Mo.

THE RICHARDSON ELECTRIC COMPANY, Duluth, Minn., has secured the contract for furnishing an engine and generator to the City Counciil of Svashwauk, Minn.

THE MOUNTAIN TELEPHONE COMPANY will extend its lines to Topton, Lyons, Bowers and Kutztown. The contract for poles was awarded to Ed. De Long and the contract for the electric supplies was given to the Western Electric Company. The exchange for the new line will be located at Mertztown.

THE DES MOINES ELECTRIC CONTRACTING COMPANY, Des Moines, Iowa, in competition with firms of Chicago and St. Louis, has been awarded the contracts for wiring the Methodist Hospital and the addition to the Des Moines Electric Company's plant.

THE NATIONAL COMPANY, South Bend, Ind., has secured the contract for the construction of an electric-light and waterworks plant at Valley, Neb.

THE TAYLOR COMPANY, New York, has recently received a contract for all of the engineering of the American Central Railroad of Texas—some 500 miles in length—and will start some ten corps of engineers to work at once, expecting to finish about January 1, 1910. The Taylor Company has recently leased a large suite of offices in the Hudson Terminal Building, 30 Church Street, New York.

THE SYLVESTER ENGINEERING COMPANY, Spokane, Wash., has been awarded a contract for the construction of the waterpower electric plant to be put in at the cement works of the Lehigh Valley Cement Company at Metaline, Wash. A forty-foot dam will be built at the outlet of Sullivan Lake and another dam will be built on Sullivan Creek some miles further up.

THE IDEAL ELECTRIC AND MANUFACTURING COMPANY, of Mansfield, Ohio, is installing individual electric-motor drive in the new mill of the Mansfield Elastic Web Company. The equipment consists of seventy motors for individual drive on elastic-web looms; three 400-ampere, alternating-current, motor-driven, low-voltage generators for electroplating service, and one 2,500-ampere and two 1,500-ampere similar dynamos. The company also has orders for two 250-kilowatt belted alternators for the Buckeye Mining and Smelting Company, Big Pine, Cal.; one seventy-five-kilowatt alternator for Clay Center, Neb.; a similar alternator for the Turnbull Elevator Manufacturing Company, Toronto, Canada; nine fifteen-horsepower slip-ring induction motors for elevators in the E. M. F. Automobile Works, Detroit, Mich.; fifteen squirrel-cage three to sixty-horsepower motors for the M. C. Peters Mill Company, Omaha, Neb.; and numerous other orders for motors and elevator equipments. The company is running its shops fifteen hours per day in trying to keep up with the contracts taken during the past thirty days, which aggregate several thousand horsepower in motors alone.

FRANK B. GILBRETH, INC., 60 Broadway, New York city, has just secured the contract for the construction of the new residence for Fred C. Sayles, at Irvington, N. Y. The building will be forty-five by ninety feet, three stories and basement, constructed of cut stone, with fireproof floors, and will have the most approved plumbing, electric wiring, steam heating, electric bell system, marble and tile work, and hardwood finish throughout. The work is to be started at once. The architects are Rowe & Keyes, 161 Devonshire Street, Boston, Mass.

HUTCHINSON & COMPANY, Alameda, Cal., have secured a contract from the Southern Pacific Railway Company for street work to be done in Alameda in exchange for its electric-line franchises, granted to it by the City Council. The construction company will start work next week on the job, which will involve a $50,000 expenditure.

Power Company Files Mortgage.

The Mojave Water and Power Company, of San Francisco, has filed notice with the county clerk of San Francisco of the creation of $15,000,000 five per cent forty-year bonds. This company, which was organized in October, 1908, with a capitalization of $20,000,000, owns water rights, lands and franchises in San Bernardino County, Cal., formerly belonging to the Columbia Colonization Company, of Chicago.

INDUSTRIAL SECTION

ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS

HIGH-EFFICIENCY TRANSMISSION CIRCUIT FOR TELEPHONE TRAIN DISPATCHING.

BY H. L. BURNS.

The use of the telephone for the handling of trains is not by any means new. For several years a number of railroads have been using the ordinary local battery, bridged telephone, for this purpose, the various stations being called by code ringing. This arrangement was found to serve very well for short lines with not very many stations. When the attempt was made to use this arrangement on longer lines, with a larger number of stations, it was found that the transmission would be seriously impaired when one or more of the receivers were off the hook at the same time. This difficulty was very noticeable later on when selectors began to be used and the telephone was introduced upon the more important and busier roads.

Fig. 1, herewith, shows schematically the usual arrangement of a local-battery telephone. Originally this arrangement was used at both the dispatchers and way stations. From the sketch it will be seen that the bridge during conversation consists of a condenser, receiver and secondary of the induction coil in series. The total impedance of this bridge to talking currents is approximately 600 ohms, about 300 ohms of which are in the receiver, and therefore active for receiving purposes. It is obvious that when a number of these sets are bridged across the line at once, the joint impedance of the bridges in parallel is very low and the transmission correspondingly difficult between terminals or widely separated stations.

An improvement on this arrangement, so far as transmission is concerned, was effected by using a larger induction coil having a low-impedance primary and a high-impedance secondary. The larger coil improved the outgoing transmission considerably, but this arrangement is not so efficient for receiving, so that the gain resulting was not great.

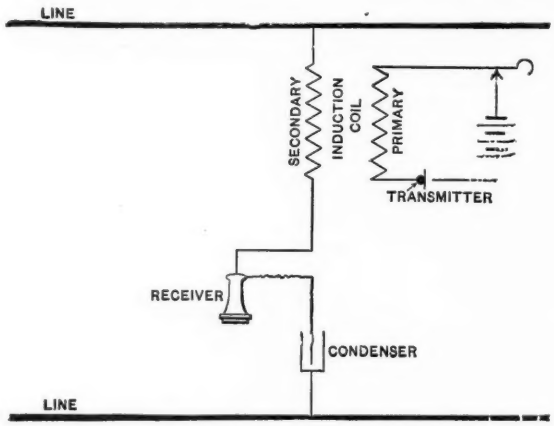


FIG. 1.—USUAL ARRANGEMENT OF A LOCAL BATTERY TELEPHONE.

To meet conditions imposed by this class of service, the Western Electric Company has devised the circuit shown schematically in Fig. 2. The dispatcher's equipment is substantially the same as shown in Fig. 1, except that special apparatus is used. In order to provide the dispatcher with the best possible receiving he is provided with instruments of fairly low impedance. A head receiver is used, and is in series with the induction coil; the latter is specially designed to give the best possible transmitting consistent with good receiving. A locking transmitter key is provided, inasmuch as the dispatcher will ordinarily require both hands for his work. The transmitter itself is of the chest type and is special for this purpose.

It will be noted that the way-station circuit is radically different from that shown in Fig. 1. In order that a number of stations may be listening at once without serious detriment to the transmission, it is apparent that each must constitute, when listening takes place, a bridge of very high impedance. Further, in order to give efficient receiving, a large proportion of this impedance must be in the receiver itself. This precludes the possibility of having the receiver in series with the induction coil, because when transmitting, all the secondary talking current passes through the receiver. The high impedance of the receiver would cut down the transmitted current, and in addition to this there would be the serious objection of excessive side tone.

A study of these conditions led to the

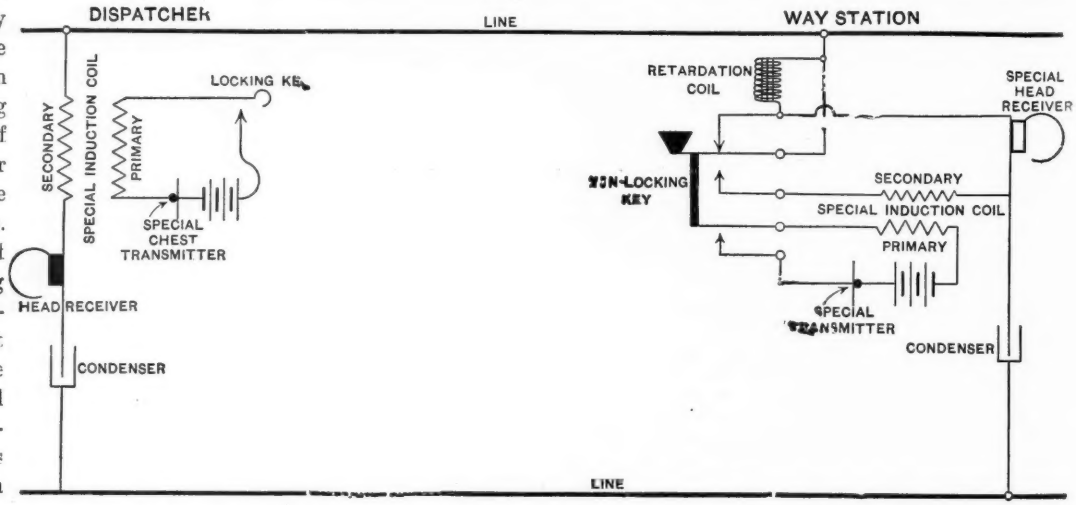


FIG. 2.—HIGH-EFFICIENCY TRANSMISSION TELEPHONE CIRCUIT.

conclusion that the use of a push-button or key which in its normal position gives the best possible receiving conditions, and in its operated position gives the best possible transmitting, would be advisable. By referring to Fig. 2, it will be noted that normally, *i. e.*, in the listening condition, there is a current through the receiver and condenser in series directly across the line. When the key is thrown to the talking position it is seen that the receiver in series with a retardation coil (normally short-circuited) is put in parallel with the secondary of the induction coil, and these bridged across the line through the condenser.

When the key is normal the receiver is directly across the line through a condenser which gives the best possible receiving conditions. The receiver is specially wound, and the impedance of the bridge at this time is about 2,400 ohms to talking current, practically all of which is in the receiver and consequently active for receiving. When the key is operated, the induction coil being bridged directly, across the line through the condenser gives the best possible condition for transmitting. The function of the retardation coil is to prevent excessive side tone in the receiver when talking, also by raising the impedance of the receiver circuit, more of the transmission is forced upon the line. This retardation coil is so designed that in case the dispatcher wishes to break in, a sufficient volume of the dispatcher's voice currents will pass through the receiver to attract the operator's attention.

The induction coil and transmitter are also special for this purpose. Three cells of dry battery or their equivalent are used for transmitter battery, the latter being in use only during the time the operator is actually talking. In developing this circuit and apparatus, the problem has been studied as a whole, rather than as a problem of transmitting or of receiving alone. The various pieces of apparatus have been designed to work together, having in view the best possible results as a whole.

Glass That Conducts Electricity.

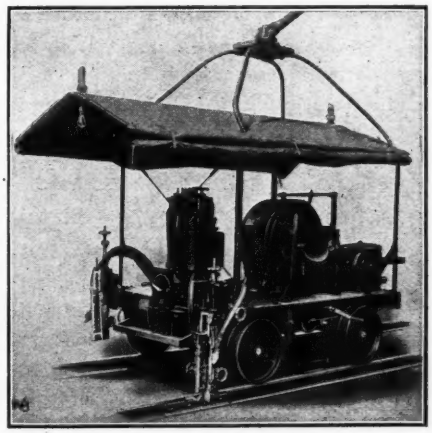
A kind of glass that conducts electricity is described in a recent issue of *Cosmos,* of Paris. It is said that the conductivity is about 1,000 times that of ordinary glass and that the new material should prove of use in making the disks of electrometers, electroscopes and similar appliances.

Electric Welding for Bonding Electric Railways.

To keep the conductivity of the track return circuit high and eliminate all trouble from defective bonds, some street-railway managers have installed return cables. This is an expensive solution of what is regarded as a serious problem to all electric railway systems which employ the track for the return circuit.

An electric welding outfit has been perfected which insures perfect bonding at a very low cost. By perfect bonding is meant bonds which will not deteriorate from moisture but will hold indefinitely because a true weld is obtained between the bond and the rail.

There are two methods adopted to obtain the perfect weld, each of which requires a satisfactory flexible bond. These



ELECTRIC WELDING MACHINE.

methods are electric welding and, so-called, copper welding.

In the first method a heavy current is passed through the bond and the rail at the point of the weld, heating both to a sufficiently high temperature to weld them together. This requires a current of approximately 2,000 amperes at five volts. This is obtained from the trolley line by means of a Westinghouse standard eighteen-kilowatt rotary converter and a special transformer which lowers the voltage to the required amount.

The secondary terminals of the transformer are one of copper and one of carbon, so arranged as to clamp the bond and rail at the point of the weld. The flow of current heats the carbon terminal to incandescence and brings the rail and the copper bond to the welding point in from forty-five to sixty seconds.

When the bonding is to be done by copper welding, molten copper is poured into a suitable mold and first heats the bond and the rail and then forms the weld. The mold is of such shape that a large reservoir of metal is formed before the bond itself is covered. This insures thorough heating of the parts and is not wasteful of copper, as the reservoir is readily chiseled off after hardening, as but a small neck connects it to the weld itself. This welding is particularly adapted to heavy bonds, return-feeder cable, and around special work.

The illustration shows the outfit as supplied by the Electric Railway Improvement Company, of Cleveland, Ohio. It will be noticed that the rotary converter may be used as a motor to propel the car. As high a speed as thirty miles per hour may be attained.

In order to remove the car from the rails to prevent interruption to the traffic, a jack-screw is fixed under the center of the car. The weight of the equipment on the car is distributed to balance about the center, so that it is an easy matter to turn the car and roll it to one side and allow a regular car to pass. Economical bonding may be done on lines maintaining a five-minute service.

For grinding the rail before welding, a small electric grinder with leads and starting box complete is provided.

For rebonding lines in city streets, this apparatus requires the removal of the paving blocks from a space of but a few inches wide and as long as the bond itself, which makes it economical for either new or old work.

A New Printing-Press Motor Controller.

In no application of individual electric drive to industrial purposes is the desirability of a properly designed controller better exemplified than in printing. The requisites of a wide speed variation and an ability to bring the driving motor to a quick stop have necessitated a special design of controller for this industry. The General Electric Company has perfected a printing-press motor controller known as CR-171, which should meet the demands of the most exacting service.

The complete controller is shown in Fig. 1, and Fig. 2 is a view with the enclosing cover removed. As will be observed, the control is obtained by means of a single handle which projects through a slot in the front of the case. All external wiring passes through a slot at the bottom.

A range in motor speed of three to one is obtained by armature and field resistance. The operating handle will remain on any resistance point for forward run-

ning, but will automatically spring back to the "off" position from the reverse point.

A valuable feature of this controller is the use of a contactor for making and

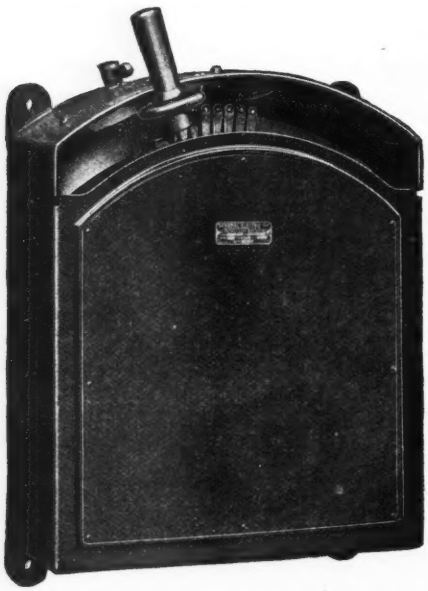


FIG. 1.—GENERAL ELECTRIC PRINTING-PRESS MOTOR CONTROLLER.

breaking all main circuits. The movement of the handle energizes the contactor and closes the motor circuit. An overload device protects the motor from too rapid acceleration or an overload at

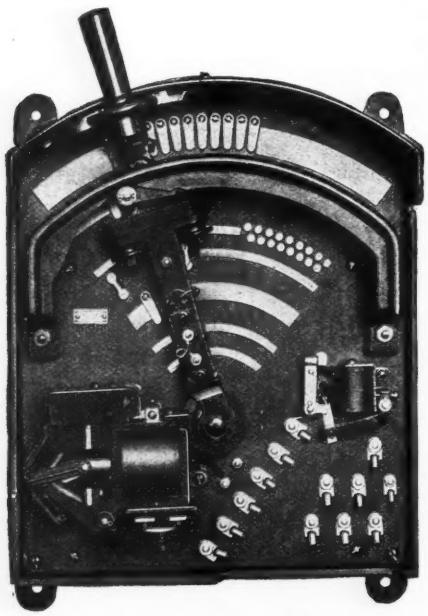


FIG. 2.—CONTROLLER WITH COVER REMOVED.

any time. Should the contactor drop out, either by reason of an overload or failure of voltage, the operating lever must be returned to the "off" position, before the contactor can again be energized.

A reliable and quick-acting braking effect is provided by means of a dynamic brake resistance, acting automatically when the motor circuit is broken.

A feature of especial value to the printing trade is the remote push-button control. A single push-button may be used to either start the motor or bring it to a quick stop from any running position. This gives the operator perfect control when "setting up." Push-buttons may be installed at any number of convenient points.

The armature and brake resistances are contained in separate boxes, and are arranged for mounting on the wall or any other convenient place. The resistance is made up of single units, which may be easily replaced. Ample ventilation is provided, thus insuring a low operating temperature.

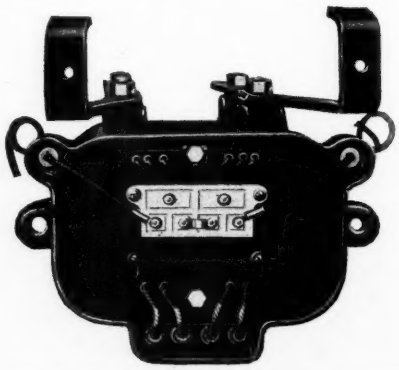
Allis-Chalmers Lighting Transformers.

Allis-Chalmers oil-insulated lighting transformers designated as the type A. L. and designed for operation on 1,050 to 2,100-volt circuits, are made in sixteen sizes, ranging from 0.6 kilovolt-amperes to fifty kilovolt-amperes. They are intended for lighting work on a normal frequency of sixty cycles per second (7,200 alternations per minute), but can be operated on any frequency from fifty to 140 cycles, the efficiency being somewhat better on the higher frequency than on the lower. They can also be operated on any voltage not over ten per cent above or below normal, but all data regarding efficiency and regulation, etc., are based on operation at normal voltage of 1,050-2,100 and normal frequency of sixty cycles per second.

A. L. transformers are of the so-called core type; that is, one magnetic circuit with coils on the two longer legs of the rectangular-shaped core.

Allis-Chalmers Company guarantees its cores to be made of such good material that they are non-aging, and transformers will have the same core loss at the end of one year's operation as when installed. This company has made every effort to reduce the exciting current to a minimum and has produced a line of transformers with very small exciting current. The smallest have an exciting current below eight per cent, the majority below two per cent, and the larger sizes below one per cent.

All transformers are wound with four low-voltage coils and four high-voltage coils, two high-voltage and two low-voltage coils on each leg. The two low-voltage coils are wound first, then the cylindrical insulation between the high-voltage and low-voltage coils placed on the low-voltage winding. The two high-voltage coils are then wound upon this



TOP VIEW OF TRANSFORMER, SHOWING TERMINAL CONNECTIONS.

insulation in reverse direction, one coil on each half of the insulation. This method of winding makes it unnecessary to bring out the start of the high-voltage coils; all leads from the coils are on the outside surface of the coils and are easily and safely insulated. Also, winding the high-voltage winding in this manner makes the number of turns per layer and the voltage per layer one-half of what it would be if the high-voltage winding were wound in one coil per leg. In A. L.

TRANSFORMER WITH COVER REMOVED.

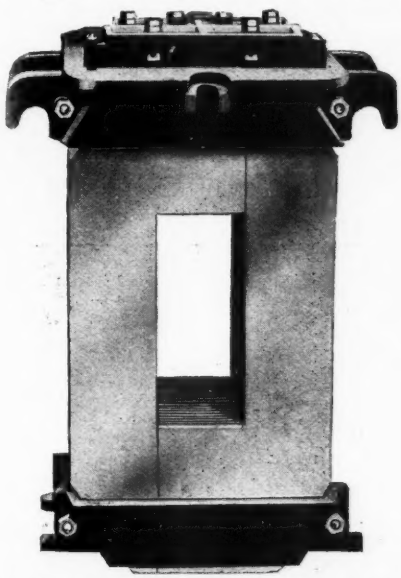
transformers the volts per layer are not over ninety volts, and in most cases much less.

The insulation between the high-voltage and the low-voltage coils is varnished cloth and mica. The mica alone is suffi-

cient to stand a test of 10,000 volts, and makes a fireproof insulation between the high-voltage and low-voltage coils, insuring the high-voltage winding being insulated from the low-voltage, even if the transformer is overloaded sufficiently to burn it out.

After the coils are wound, they are dried out under a vacuum, and when thoroughly dry are impregnated with an oil-proof compound, hermetically sealing up the coils.

A. L. transformers are provided with taps on each end of the 2,100-volt windings. This enables normal secondary voltages, viz., 105/210 volts, to be obtained from either five per cent or ten per cent below 2,100 volts supplied to the primary winding. With 2,100 volts supplied to primary, either 100, 105 or 110 per cent of normal secondary voltage can be obtained. With 1,050 volts supplied, one ten per cent tap on the primary winding is available. In other words, these transformers can be used to step down from 2,100 volts in the ratios four-and-one-half, four-and-three-fourths, five, nine, nine-and-one-half, ten, eighteen, nineteen, or twenty to one, and can be used to step down from 1,050 volts in the ratios two-and-one-fourth, two-and-one-half, four-and-one-half, five, nine, or ten to one. That is, A. L. transformers can be used to step down from any voltage within ten per cent above or below 2,100 volts in nine different ratios and can be used to step down from any voltage within ten per cent above or below 1,050 volts in six different ratios. Any increase in primary voltage gives proportional increase in secondary voltage. Allis-Chalmers Company guarantees A. L. transformers to carry full load in kilovolt-amperes on any tap, if operated within ten per cent of normal voltage.



ASSEMBLY OF CORE OF ALLIS-CHALMERS TRANSFORMER.

These transformers will carry full load continuously with a temperature rise of forty-five degrees centigrade, and will carry twenty-five per cent overload for two hours immediately following full-load run, with a temperature rise of fifty-five degrees centigrade, and will carry twenty-five per cent overload continuously with a temperature rise of sixty-five degrees centigrade. These temperatures may be measured by thermometer or by the resistance method, or by both.

All transformers are given rigorous tests as soon as completed, comprising resistance of windings, polarity, ratio, core loss, impedance and insulation.

A. L. transformers are given an insulation test of 10,000 volts between the high-voltage winding and the low-voltage winding and core. An insulation test of 2,500 volts is given between the low-voltage winding and core. These tests are applied for one minute. All transformers are operated for five minutes at three times normal voltage and also at 150 per cent load for twenty minutes.

Drawback on Imported Lamp Bases.

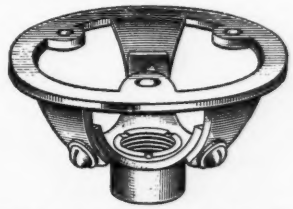
The United States Treasury Department has issued a ruling to the effect that on the exportation of Edison incandescent electric lamps, manufactured by the General Electric Company, of New York, with the use of imported bases, drawback will be allowed equal in amount to the duty paid on the imported material used, less the legal deduction of one per cent. To secure this drawback it is required that the preliminary entry must show the marks and figures of the shipping packages and the number of lamps contained in each package and in the shipment.

The drawback entry must show the total number of lamps exported and the number of imported bases used in the manufacture thereof, and in addition to the usual averments, that said lamps were manufactured of the materials and in the manner set forth in the manufacturer's sworn statement, which has been filed with the collector of customs.

In liquidation the number of imported bases which may be taken as the basis for the allowance of drawback may equal the number used as declared in the drawback entry after official verification of the exact quantities, provided it shall not exceed one base for each lamp. A. F. T.

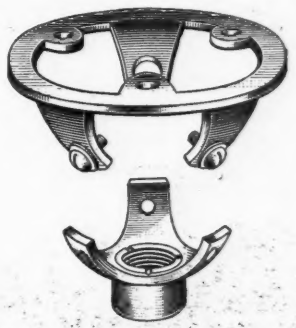
Emery Adjustable Tripod.

The Fairmount Electric and Manufacturing Company, 2324 Market Street, Philadelphia, Pa., has recently placed on the market a two-piece separable and adjustable tripod or crowfoot for the suspension of lighting fixtures.



EMERY ADJUSTABLE TRIPOD.

As the upper portion, shown in one illustration, can be screwed to the ceiling before the fixture is hung, the workman is relieved of the support of any extra weight, making it easy to fasten the tripod securely. Furthermore, the bottom portion may be adjusted so that even though the ceiling is irregular or the threading not true, the fixture will hang vertically. This, of course, obviates any necessity of placing blocking under the tripod. The assembled tripod is shown in the accompanying illustration.



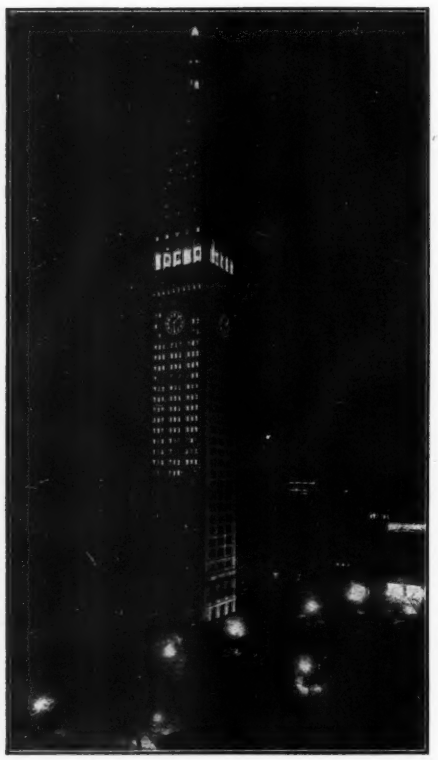
ADJUSTABLE TRIPOD DISSEMBLED.

Graphite in Lubrication.

The National Fire Protection Association's Committee on Artificial Refrigeration recommends "That wherever in any system graphite can be used as a lubricant in compression cylinders, that it be done. This especially applies to air compressors used in dense air systems and for air compression for purposes other than refrigeration, as the temperature of the compression cylinders undoubtedly rises in some air systems to a point where inflammable vapors may be generated from lubricating oil." The use of unctuous, soft, pure graphite, manufactured by the International Acheson Graphite Company, Niagara Falls, N. Y., is recommended for the above purpose, as well as for lubrication in general.

Lighting and Power Plant of the Metropolitan Building.

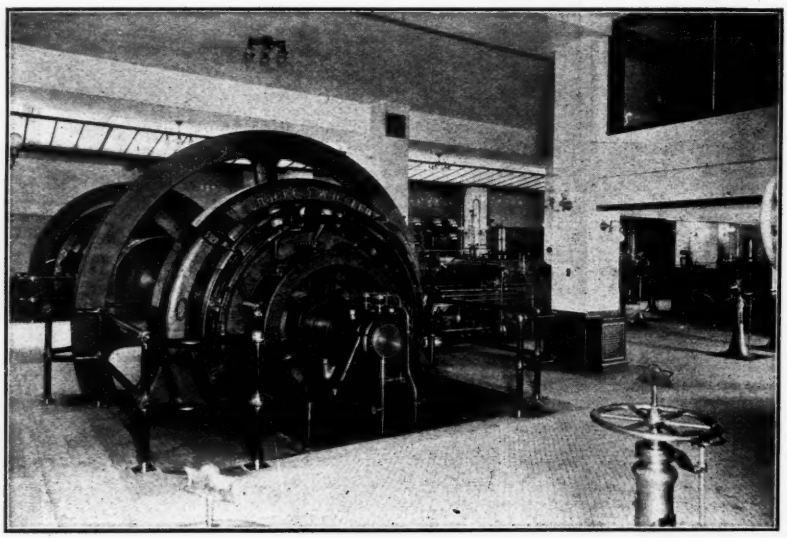
One of the things that aided the extraordinary exhibition of lighting in New York city during the Hudson-Fulton Celebration, was the fact that many modern office buildings supplied their own current from their own isolated plants. This was the case with one of the most remarkable light exhibits, namely, the Metropolitan Life Insurance Tower on Madison Square. The photograph herewith, taken between daylight and dark, startling as it is, gives but a faint impression of the effect secured by the great tower during the illumination. The current for the Metropolitan Tower and Building is supplied by the Metropolitan power plant in the southeast corner of the building.



ILLUMINATION OF METROPOLITAN BUILDING.

This plant is a model equipment in every sense of the word. The principle of publicity which is so strongly emphasized in the prominent construction of the building has been carried out thoroughly in the location of the engine room. The room used for the electric plant in many buildings seems to be chosen for that purpose mainly because it cannot conveniently be used for anything else. Here, on the other hand, a spacious section, fifty feet wide and over 100 feet long, is utilized. In the center of the plant is situated a large glass-enclosed observation gallery, from which a visitor may view the entire equipment. The effect of this publicity on the appearance of the equipment has been unmistakable. The unusual cleanliness of floors, walls and machinery has made the plant a show feature of the building. Another noticeable condition is the entire absence of hum and vibration. The plant contains four 120-volt, 100-revolution-per-minute, Crocker-Wheeler direct-current generators with a combined capacity of 1,100 kilowatts. Its appearance is well brought out in the accompanying illustration.

The tower of this building is lighted by special reflectors installed by the firm of I. P. Frink, 551 Pearl Street, New York. The special lighting effects produced by these reflectors are truly wonderful. The clock dials are distinct and impressive. The lantern at the extreme top is over seven feet in diameter and has the appearance of one mass of fire. It indicates the hours by flashes of white light. Red flashes indicate the quarter-hours: One for the quarter-past each hour, two for the half-hour past the hour, three for the three-quarters past the hour.



VIEW OF ENGINE ROOM, METROPOLITAN BUILDING.

A Novel Turbine Installation.

The Allis-Chalmers Company has recently received an order from the Diamond Rubber Company, of Akron, Ohio, for a rather novel installation. This will be a low-pressure turbo-generator set receiving its steam supply from the exhaust of the vulcanizers and other apparatus. The set has a capacity of 1,000 kilowatts when running at 1,500 revolutions per minute and will furnish twenty-five-cycle, two-phase, 240-volt current. The turbine will have a continuous overload capacity of 1,250 kilowatts. The initial steam pressure will be about sixteen pounds absolute and the vacuum vary from twenty-six to twenty-eight inches, depending on the temperature of the condensing water at various seasons of the year. In connection with this turbine, Allis-Chalmers Company is furnishing a special condenser outfit. The condenser head, which is similar to that used on their type "C" condensers, will be connected to the expansion joint of the exhaust line where it leaves the turbine. The mixture of steam, water and air coming from the head will be removed by a centrifugal pump driven by a small impulse steam turbine. The dry air pump will be driven by a small reciprocating engine. Both these auxiliaries will run on high-pressure steam, and the exhaust from them, which will be at atmospheric pressure, will be used in the large low-pressure turbine. This makes the most economical arrangement possible.

Junior Electrical Engineer, Geological Survey.

The United States Civil Service Commission announces an examination on November 23-24, 1909, to secure eligibles from which to make certification to fill a vacancy in the position of junior electrical engineer in the Technologic Branch of the Geological Survey, at a salary ranging from $960 to $1,200 per annum, and vacancies requiring similar qualifications as they may occur. Those interested should write to the commission at Washington, D. C., for Circular No. 624.

Current Electrical News

GREAT BRITAIN.

(Special Correspondence.)

LONDON, OCTOBER 22.—The Bremer flame arc lamp patent, which is owned by the British Westinghouse Company, was held to be invalid in the law courts this week, on the ground of want of subject matter. It was further held that the patent has been anticipated by the patent granted to Graham in 1882 and therefore is also invalid on this ground. The learned judge held that the Bremer patent merely covered a mechanism for feeding the carbons in a specified type of arc lamp when, as a matter of fact, the same mechanism had already been used in other types of arc lamp. Consequently, as the patent covered a matter which was already within public knowledge, there was no invention. This decision was given in connection with an action taken by the British Westinghouse Company for infringement of their patent by another arc lamp maker and importer named Braulik and in view of the fact that the Westinghouse company had alleged that practically every flame arc lamp here infringed the Bremer patent, this decision will be hailed with delight by British makers of flame arc lamps. The Westinghouse company, however, has given notice of appeal, so that the fun is not ended yet.

There is also going to be some excitement in connection with metal-filament lamps. I mentioned a few weeks back that the famous gas-mantle company, known as the Welsbach Company, had suddenly put a metal-filament lamp upon the market, with a wonderful offer to install them for carbon lamps in any existing installation, free of charge. I believe, as a matter of fact, that this offer was very soon withdrawn, for no expressed reason. Nevertheless, the company is pushing the new lamp very vigorously, in fact too vigorously for some of the existing metal-filament lamp makers. The mystery attaching to the lamps exploited by the company is that they have the trade name of "Aur," when it has always been accepted that the original "Aur" patents belonged to one of the leading companies in London. We now hear that summonses are being taken out against the Welsbach Company for applying a false trade name to their goods, and as the later have challenged any aggrieved person or persons to take the matter into court, some interesting proceedings are likely to take place.

Yet another piece of legislation is going on in connection with electrical work, viz., an alleged infringement of a British patent for the electrical driving of printing presses by Kohler Brothers, the latter having, I believe, made a special journey to this country to contest the action. The proceedings, however, are against the owners of the newspapers in whose premises the alleged infringing machines are used. In this case also it is alleged by the opposition that the British patent in question is invalid for want of subject matter and also by reason of anticipation, but judgment has not yet been delivered.

An interesting and important report—in so far as it is impartial—has just been issued upon the question of electrically driven textile machinery by a committee formed by the Bradford Engineering Society. The result of this report is absolutely in favor of electrical driving, especially in relation to flexibility, ease of extension, saving in floor space, saving in initial cost of plant where power is taken from an outside source, and less liability to stoppage. All this has been arrived at by actual experiments in mills, as has also the conclusion that the regularity of drive is more pronounced with electrical than with mechanical transmission of power. This report is in a different category to the usual report upon this subject, in as much as it was undertaken by a disinterested society with the sole object of arriving at definite opinions from actual experiments in mills under working conditions.

The Engineers Standardized Publications' Association was formed in London a little while ago in order to introduce some degree of uniformity into the publications of engineering firms in the way of catalogues, etc. The movement appears to have met with some support and an advisory committee has been formed in order to actively pursue the objects for which the association was started. Up to the present the greatest measure of co-operation has come from central-station engineers, and a start is now to be made to bring engineering firms into line.

Not satisfied with the multifarious lamps to be seen in the city of London for the purposes of street lighting, the city corporation has just sanctioned the carrying out of further experiments, although what form these are to take is not made clear. At present we have within the famous square mile, high and low-pressure gas lamps on posts, high-pressure gas lamps on brackets, ordinary arc lamps and flame arc lamps on posts and flame arc lamps strung across the streets.

The District Railway Company is faced with the difficulty of dealing with somewhat large arrears of interest upon its guaranteed and preference stock, and a scheme for funding seventy-five per cent of the arrears into a security and writing the balance off has been placed before the stockholders. G.

CONTINENTAL EUROPE.

(Special Correspondence.)

PARIS, OCTOBER 23.—In Italy there has been constructed a hydraulic plant which ranks among the largest in the country to be used for electric furnace work. It supplies current to the new electro-chemical works located at Narni. The Societa Industriale of Valnerina controls the electrolytic plant, as well as the power station, and at present it is turning out a considerable amount of products, especially carbide of calcium. The hydraulic plant has an electric outfit which is supplied by the Milan branch of the Oerlikon company, and at present there are six turbine-alternator units installed in the station. This latter is located on the Cervara River at Terni, and the water is brought from the barrage in an open canal of 390 metres length to a large settling basin, from which there run two parallel flumes, cut in the mountain side for a distance of 520 metres. A total head of water of nineteen to twenty-three metres is obtained in this case.

Electric train lighting is being adopted on a large scale by the Paris-Orleans Railroad, and the company recently placed an order with the Paris branch of the Brown-Boveri firm, whose factory is located in the suburbs, for 900 train-lighting outfits of their new system, for lighting passenger cars. The Brown-Boveri method uses a special forty-eight-sixty-four-volt generator, whose voltage is variable, and the generator is of small capacity. By means of an automatic voltage regulating device the lamps can be run with a maximum voltage variation of two-and-one-half volts, no matter what may be the speed of the train. This latter is between twenty and eighty miles an hour.

It has been decided to proceed with erecting a hydraulic plant of considerable size in the region of Naples, and it is to furnish current for that city. The power station will be located at the sources of the Volturno stream and is about forty-five miles distant. Current will be brought over a high-voltage, three-phase power line, working at 45,000 volts, at least. It is expected to secure about 16,000 horsepower for the new plant, and the alternators will use a standard voltage of 5,000 volts. The construction of such a plant had been talked of for some time past, but it is only within a late period that the question has been actually decided. A. DE C.

EASTERN CANADA.

(Special Correspondence.)

OTTAWA, ONT., OCTOBER 30.—The Rio de Janeiro Tramway, Light and Power Company, a Canadian corporation, has declared an initial quarterly dividend of one per cent.

A syndicate consisting of manufacturers of Oshawa, Ont., will build an electric road from Cobourg to Toronto. The new line will be called the "Toronto and Eastern." Work will be well advanced within a year.

A special general meeting of the shareholders of the Mexican Northern Power Company will be held at Montreal on the 17th of November, for the purpose of considering a by-law to increase the capital stock of the company from $10,000,000 to $15,000,000, and also for the purpose of considering an increase in the amount of the company's bonded indebtedness from $7,500,000 to $10,000,000.

Port Arthur, Ont., has been notified by the Dominion government that a license will not be granted to the United Wireless Telegraph Company, to build a station at Port Arthur, for which arrangements had been made between the Town Council and the company. It is the intention of the government to retain control of all wireless communication, and it is likely that three stations, enough to protect the lake shipping, will be built about the Great Lakes in the next couple of years.

The Montreal Street Railway Company has sent a statement to the City Council showing that, for the current year, the city of Montreal will get, on the earnings of the company, the sum of $259,171. Last year the sum received by the city was $241,967. The total earnings of the company for the current year, upon which the percentages to the city are based, was $3,261,145. According to the city's contract with the company, it gets from four to fifteen per cent. The percentage on the first million dol-

lars is four per cent, and then the percentages gradually increase until the limit of fifteen per cent is reached.

The Southwestern Traction Company, which runs from the city of London, Ont., to St. Thomas and Fort Stanley, has been sold at public auction for $535,000. The actual bid was $455,000, but the purchaser has to bear a lien of $80,000. The sale was rendered necessary by the large overhanging debt which was incurred at the start. For the last two or three years the enterprise has been a splendid paying proposition, but the financial obligations retarded its work.

The Trenton Electric Light and Water Company is trying to get an agreement through the Council for the town of Trenton, whereby all the privileges held by the town, under the Dominion government, in the Trent River waterpowers, are to be conveyed to the company in perpetuity, and for what are claimed to be nominal considerations. The town has now an opportunity, by defeating the by-law, to throw off the thrall of the company, which has a forty-year exclusive franchise on the streets of the town for lighting purposes and control of the water system. The Town Council favors the company, but, under the new provincial law, the agreement is to be voted on by the ratepayers on November 1.

Signor Marconi, who has returned from his visit of inspection to the transatlantic station at Glace Bay, Nova Scotia, confirms the announcement that he hopes to have the transatlantic system in regular operation by the first of the year. "The work of rebuilding is in progress at Glace Bay now," said he, "and we hope to have the installation complete before the end of the year. It is only a matter of getting the building ready to house the apparatus. As soon as the installation is complete, I expect that the contract with the British post office will come into effect. Under that agreement, they give us the same facilities as they give the cable companies; that is, each post office in the United Kingdom would be a collecting and distributing agency for us. Until the new apparatus was installed I had not been anxious to bring this contract into operation, as the old plant at Glace Bay might not have been equal to the handling of the large number of messages we are likely to get." Signor Marconi stated that the stations taken over by the British government were six in number and were used for the purpose of communicating with ships. The company still retains four or five stations. The British government has not taken over any of the rights of the company in regard to transatlantic messages, nor in regard to the transmission of messages from shipboard. Signor Marconi also stated that if the land telegraph lines in Canada do not give the company the same terms as they give the cable companies, then his company will build its own stations throughout the country.

IMPORTANT DEVELOPMENTS.

(Special Correspondence.)

TO DAM THE GILA RIVER—A syndicate of Denver and Colorado Springs capitalists will build a dam across the Gila River, fourteen miles below San Carlos, Arizona, and establish a system of irrigating canals and ditches at an estimated cost of more than $1,000,000, if it succeeds in plans which are now under way. It is reported that the syndicate will also erect a large hydroelectric plant and build transmission lines to towns and mining camps in the surrounding territory.

NEW EXTENSIONS IN BROOKLYN—The Kings County Electric Light and Power Company, of Brooklyn, has applied to the New York Public Service Commission for permission to issue $5,000,000 of six per cent convertible debenture bonds, payable twelve years from date and convertible into stock at par at any time after three years from the date of issue. The proceeds are to be used for construction and extension, as follows: $3,539,660 to reimburse the Kings County company and the Edison Electric Illuminating Company, of Brooklyn, which joins in the petition, for expenditures for improvements and payments already made, and $1,460,340 for improvements to be made during this year and 1910. Improvements for the Edison company will be paid for by demand notes of that company issued to the Kings County company upon its advancing the funds obtained from the sale of the debentures. The $5,725,000 four per cents of the Edison company, authorized but not issued, are to be held for unknown contingencies. Both companies hold franchises in Brooklyn, but the Edison company operates the property of both, while the Kings County company is the financing company and owns all the stock of the former.

LARGE MEXICAN POWER PROJECT—The syndicate of Montreal, Canada, which has already invested many millions of dollars in electrical and railway enterprises in Mexico, particularly in the vicinity of Mexico City, has recently extended its operations to Northern Mexico, where it has just let the contract for the construction of a great dam across the Conchos River in the state of Chihuahua for the purpose of forming a reservoir of water to afford the initial power for its proposed hydroelectric plant to be installed there. A separate company has been organized to carry out the plans for this new project. It is called the Compania Agricola de Fuerza Electrica. The contract for building the dam was awarded to S. Pearson & Son, Limited. Its cost will be about $7,500,000 gold. Embraced in this contract is the building of a system of irrigation canals and ditches which will be operated in connection with the electrical enterprise. The dam will be the second largest dam on the American continent, it is said. It will form a reservoir which will have a capacity of 1,840,000,000 cubic metres of water, which will be 180,000,000 cubic metres more than the capacity of the great Tonto Basin Dam in Arizona. The proposed hydroelectric plant will have a capacity for generating 25,000 horsepower. It is stated that contracts have already been made for the utilization of practically all of this power. It will be transmitted to the towns of Chihuahua, Parral, Jiminez, Santa Rosalia and a number of smaller places and to several large mining camps within a radius of 200 miles of the plant. The company has also let the contract for the construction of a standard-gauge railroad about twenty miles long, which will run from the site of the proposed reservoir to a connection with the Mexican Central Railroad at Santa Rosalia. This road will be built immediately so as to afford a means of transporting the material and supplies to the building site.

LIGHTING AND POWER.

(Special Correspondence.)

WEWOKA, OKLA.—This city has voted bonds to establish an electric-light plant.

LINDSTROM, MINN.—It is reported that an electric-light plant will be installed shortly. C.

HARROLD, S. D.—The new electric-light plant has been started and found to be satisfactory. C.

TACOMA, WASH.—The Board of Public Works is advertising for 40,000 pounds of copper wire.

KENMARE, N. D.—The Kenmare Light and Power Company has installed a twenty-four-hour service. C.

BUFFALO, MO.—The Big Naungua Power Company has been incorporated, with a capital stock of $490,000.

LAFAYETTE, ORE.—A franchise has been granted for the establishment of an electric-light plant here.

MANDAN, N. D.—The Bismarck Electric Light Company will furnish the power to be used in the plant here. C.

ROCHESTER, MINN.—A vote will be taken October 26 on the construction of a municipal electric-light plant. C.

PIERRE, S. D.—The Metallic Electric Purification Company has been incorporated, with a capital of $1,000,000.

TOWNER, N. D.—The Council has employed an engineer to prepare the cost of installing an electric-light plant. C.

DE QUEEN, ARK.—The De Queen Ice and Light Company has been incvorporated, with a capital stock of $50,000.

DURANT, OKLA.—This city is to vote on a bond issue of $50,000, part of which is to establish an electric-light plant.

TOWNER, N. D.—An estimate of the cost of installing an electric-light plant is being prepared by E. D. Jackson, engineer, St. Paul, Minn. C.,

WATERTOWN, S. D.—Mr. Ferris, manager of the electric-light plant, is considering the erection of an up-to-date plant near the Sioux River. C.

McKINLEY, MINN.—The contract for the installation of a boiler at the electric-light plant was let to Fairbanks, Morse & Company, of St. Paul. C.

HOQUIAM, WASH.—The Montesano Planing Mill Company has been granted a franchise to install an electric plant to supply the city with light.

CENTRAL CITY, NEB.—The construction of an electric-light plant will shortly be commenced by D. Y. Clark, who has the contract for its erection. C.

SAN BERNARDINO, CAL.—The Board of Supervisors have accepted the bid of the California Edison Company for lighting the streets of the town of Highland.

EUREKA, CAL.—The Smith River Electric Company will furnish light to Humboldt and Del Norte counties in California and to Josephine County in Oregon.

AUBURN, CAL.—The Board of Supervisors have granted Dr. Robert Pears a franchise for an electric transmission line along the county road between Colfax and Auburn.

AINSWORTH, NEB.—A stock company has been formed, Walter Williams, secretary, to build a dam at Plum Creek, fifteen miles northeast, for the purpose of furnishing the city with electricity. C.

BOSTON, MASS.—The Edison Electric Illuminating Company, of Boston, has applied to the gas commission for authority to issue 19,452 shares additional capital stock, the proceeds to take up notes issued for new properties acquired last

month at a cost of about $2,870,000; also notes issued from time to time to take care of the normal growth of the business amounting to about $1,000,000.

ODESSA, WASH.—The City Council has passed an ordinance granting a franchise to the Washington Water Power Company of Spokane to install an electric-light and water system in Odessa.

SAND POINT, IDAHO—The Northern Idaho & Montana Power Company will begin the construction of a power house and a substation here before long. The power house will cost $100,000. A.

OAKVILLE, WASH.—W. A. Shoemaker, who has sold his power plant at Buckley, has been granted a franchise by the City Council to install an electric-light and water system in Oakville.

SPOKANE, WASH.—The Kettle River Water Power Company has been incorporated here, with a capital stock of $500,000, by E. L. Tate, R. L. Thompson, W. W. McCreary, Chas. Grant and R. H. Voorhies.

WASHTUCNA, WASH.—W. A. Gildersleeve, who is putting in an electric power and lighting plant at this place, is planning the extension of a transmission line to La Crosse to supply that place with light.

MONTEREY, CAL.—The Monterey County Gas and Electric Company is preparing to extend its transmission line from this place to Salinas and other points. The extensions will total about thirty miles.

EUGENE, ORE.—The Junction City electric-light plant has been purchased by the Northwestern Corporation. This company will supply the city with light and power from the plant now being constructed on the McKenzie River.

WASHBURN, WIS.—The Washburn Electric Light and Power Company has placed an order for the material for the receiving station to be established here. The contract has also been let for building the line to the city limits of Ashland. C.

CRESCENT CITY, CAL.—The Smith River Electric Company will start operations on a large power plant on Smith River, ten miles from Crescent City, within the next two months. About 3,250 horsepower will be generated by this plant. A.

WHIPPLE BARRACKS, ARIZ.—Sealed bids will be received at the Constructing Quartermaster's Office here up to November 10 for furnishing labor and material required for the construction of an electric-lighting system at Whipple Barracks.

DEMING, N. M.—B. P. Small, who with others is planning the erection of a central power plant at this place, writes from Wichita, Kan., that he has closed a deal with the Western Construction Company for the construction of the plant.

PORTERVILLE, CAL.—S. E. Henley and others of this locality are planning to develop about 4,000 horsepower of electric energy at a site near Springville, in this county. The plant will be built by a company which is now being organized.

BIRMINGHAM, ALA.—The incorporation of the Birmingham Water, Light and Power Company, capital $25,000, has been perfected. The plant is to be located on the Sipsey River, in Walker County, and supply power to Birmingham and other cities.

LOS ANGELES, CAL.—Mayor Alexander has sent a special message to the City Council recommending that the question of issuing bonds to the amount of $3,500,000 for developing power from the Owens River Aqueduct be submitted to a vote of the people.

BOSTON, MASS.—The committee to investigate the needs of the Marblehead Electric Light and Power Plant recommends the town to make an appropriation of $28,000, of which $13,000 is for additional new equipment and the balance for renewal and rearrangement.

TOLEDO, OHIO—The Village Council, of Genoa, Ohio, has entered into a contract with the Toledo, Port Clinton & Lakeside Company, to supply the town with electric-lighting system. There will be at the start twenty arc lamps distributed through the various streets. H.

NORWICH, CONN.—The Falls Company, manufacturer of textile fabrics, has begun the erection of an electric power plant at the dam near the Chelsea File Works. It is proposed to generate 200 horsepower and to transmit it over high-tension wires to the company's plant.

DUNSMUIR, CAL.—The Siskiyou Electric Power and Light Company's pole line from the power plant on Fall Creek to Dunsmuir is practically completed. The line is sixty-five miles in length and will furnish electric power and lights to the towns of Dunsmuir, Sisson, Weed and intermediate stations. The company, which has its headquarters in Yreka, now has close to 200 miles of power line, serving, in addition to the towns named, Yreka, Ashland, Montague, Hornbrook, Fort Jones, Greenview and Etna Mills. The company supplies power to several mines and dredges as well. The main power plant is on Fall Creek, fourteen miles up Klamath River from Klamathan. A smaller plant is on Shasta River.

FRANKTON, IND.—A right-of-way is being condemned across farms from Elwood to this city, a distance of six miles, for the purpose of placing poles and stringing wires, in order to carry out a contract to furnish electric lights for Frankton. S.

JAMESTOWN, N. Y.—The Municipal Lighting Commission has adopted a resolution recommending the purchase of the system of the Jamestown Lighting and Power Company, the private plant for $90,000 and the appropriation of $30,000 for consolidating it under one roof with the municipal plant.

SALISBURY, N. C.—The board of aldermen by a 5 to 3 vote has granted a franchise to parties interested in building an interurban electric line into the town from Concord, twenty-three miles south, the Salisbury franchise to become operative when ten miles of the interurban tracks toward Concord have been completed. L.

BELLINGHAM, WASH.—L. H. Bean, manager of the Whatcom Railway, Light and Power Company, has left for the East to arrange for the doubling of the company's plant on York Street in this city. It is planned to spend about $140,000 in this work. A new waterwheel will also be put in at the company's generating plant on the Nooksack River.

HELENA, MONT.—The following bids were received for the construction of an electric-light plant: The Sheffield Power Company, Kansas City, Mo., $20,000, and the Kilborn & Clark Company, Seattle, Wash., $26,000, each plant to be 400-horsepower. An order temporarily restraining the city from entering into the contract has been issued by Judge J. Miller Smith. C.

DURANGO, MEXICO—Charles von Brandis, of Durango, is arranging to construct a hydroelectric plant at the El Salto waterfall, situated fifty miles west of that city. The electric power will be distributed to towns and mining camps within a radius of one hundred miles, it is said. The federal government has granted a concession for the enterprise. D.

JAMESTOWN, WIS.—At the monthly meeting of the board of electric light commissioners last week it was voted to recommend to the Common Council that there be submitted to the people a proposition to issue $120,000 in bonds for the purchase of the plant of the Jamestown Light and Power Company, for the purpose of consolidating it with the municipal plant.

INDIANAPOLIS, IND.—The custodian of the Indiana Capitol Building is asking for bids for supplying light and power for the building for two years. The Board of Control has employed a competent engineer to estimate the cost and advisability of erecting and equipping a plant to supply electricity for light and power for the State House and State Soldiers' Monument. S.

DODGEVILLE, WIS.—A movement has been started at Dodgeville to construct a system of dams and reservoirs on the several creeks around here emptying into the Wisconsin River, in order to develop waterpower. There is a large amount of power available and dams used only be built. The several mining camps in this region would use all the power generated. C.

PORTLAND, ORE.—A building permit has been issued to the Portland Railway, Light and Power Company by City Auditor A. L. Barbur, for the building of the company's new barns at Sellwood. Pits, tracks and the foundation for the buildings have been built already and the work on the superstructure will start at once. The permit says the improvement will cost $55,000.

PORTLAND, ORE.—The Portland Water Power and Electric Transmission Company has established offices in the Chamber of Commerce Building in this city and has taken preliminary steps toward the building of a power plant on its recently-acquired property two miles from Estacada. W. H. Hurlburt, president of the company, will have the active management.

NEW WESTMINSTER, B. C.—A magnificent station will be erected in this city shortly by the British Columbia Electric Company. The building, which will be the hub for the tram lines netting the Fraser Valley, will have the ground floor finished with marble. The upper stories, the structure consisting of three at first, and eventually five, are to be used for offices.

AUTLAN, MEXICO—It is reported that the concession which was granted by the Mexican government four years ago to L. O. Harnecker for the construction of an electric railway between Autlan and the Pacific port of Chamela is about to pass into the hands of a German syndicate. If the transaction is consummated it is said that the construction of the line will soon be started. D.

SOUTH SAN FRANCISCO, CAL.—The Board of Trustees of this place has refused a permit to the Sierra and San Francisco Power Company (the company which is to supply the United Railroads of San Francisco with power) to erect its transmission towers and line in this city pending an investigation of the report that the company has agreed with the South San Francisco Light and Power Company not to sell current in South San

Francisco. As the Sierra and San Francisco Power Company must carry its line through South San Francisco in order to enter San Francisco, the work on the transmission line has been temporarily stopped.

MEXICO, MEX.—It is reported that plans have been completed by a $10,000,000 power company for building a dam and the erection of a 20,000-horsepower hydroelectric power plant on the Nazas River, twenty-five miles above Torreon, Coahuila, Mexico. The names of the persons interested in the foregoing enterprise may be obtained from the Bureau of Manufactures, Washington, D. C.

FERGUS FALLS, MINN.—The Otter Tail Power Company will purchase additional power equipment for the Dayton Hollow station. The dam was not damaged by the recent series of disasters at Fergus Falls. A contract has been entered into between the company and the city for lighting service. Plans for additional machinery are being drawn by Edw. P. Burch, engineer, Minneapolis, Minn. C.

ATHOL, MASS.—The Massachusetts Gas Commissioners have approved an issue of $174,800 additional capital stock, par value $100, of the Athol Gas and Electric Company. The proceeds of 685 shares are to be used to refund outstanding bonds, coupon notes and a complete payment for the plant of the Orange Gas and Electric Light Company, the remaining 1,030 shares for the payment and cancelation of an equal amount of obligations of the company.

GREENVILLE, S. C.—The Southern Power Company is erecting a modern substation near the city through which current from Great Falls for the Monoghan mills and the Woodside cotton mills, will be handled, and the high-voltage transmitted current reduced to lower voltage and made available for any of the numerous mills about Greenville. There has been some delay in completing the transmission lines, but final surveys are now being made and the current will be brought to the city shortly. L.

SPRINGFIELD, ILL.—The Springfield Light, Heat and Power Company will have its new 1,500-kilowatt direct-connected alternator in running order in time to carry the extra load that it will have during State Fair week. The company will have in addition to the extra lighting a load of 5,000 eight-candlepower lights that will be used for street decorations for the Fair and will also have the extra lighting of the individual merchants, who will use the lights for streets in front of their places of business. V.

OROVILLE, CAL.—General Manager H. D. Sinclair, of the Great Western Power Company, states that preliminary work on the company's permanent dam will begin at once. The temporary dam is now being put in shape to resist the winter's storms. The transmission line will be raised to a voltage of 100.000 during the present month. The company has entered into contracts to supply the shops of the Western Pacific Railroad Company at Oroville, Sacramento, Oakland and Oakland Mole with power.

ASHEVILLE, N. C.—An order has been made in federal court here by Judge J. C. Pritchard confirming the sale of the Rock Hill, S. C., Water, Light and Power Company by the receiver, P. A. Wilcox, of Florence, S. C., to Martin Maloney, the highest bidder for the property, at $80,000, and also the sale by the same receiver to the same purchaser, Mr. Maloney, of the Carolina Water, Light and Power Company, of Darlington, S. C., at $51,000, and the property of the Marion, S. C., Light and Power Company to Mr. Maloney for $50,000. L.

URBANA, ILL.—The University of Illinois will begin construction at once of a new power plant, arrangements for which are in charge of a committee consisting of W. L. Abbott, of the Board of Trustees, W. F. M. Goss, dean of the College of Engineering and Prof. James M. White, supervising architect of the university. Contracts for boilers, stokers, chimneys, engines and generators have already been closed. W. C. Zimmerman, Illinois State Architect, Steinway Theatre Building, Chicago, is the architect for the building, and W. H. Zimmerman, of Chicago and Lansing, Mich., is consultinng engineer.

HAMILTON, ONT.—The special power committee met on Thursday last week and passed a recommendation to the City Council to sign the contract with the Hydro-Electric Power Commission for 1,000 horsepower, under the terms offered last June by the Commission, with the option of entering fully into the project by December 21, 1910. If the Council adopts this course, it will put an end to a question which has overtopped in importance anything else that has arisen in municipal circles within the last three years. Though the power committee passed the above recommendation, it was not unanimous, Mayor McLaren and two aldermen stating that they would reserve till the next Council meeting what they would have to say on the question, which indicates that the struggle is not yet over, though a majority of the aldermen are known as "hydro" aldermen and, it is said, are in favor of entering into the contract with the Commission.

ELECTRIC RAILWAYS.

(Special Correspondence.)

OGDEN, IOWA—It is expected that the Fort Dodge, Des Moines & Southern will build a line to Ogden next spring. C.

ABERDEEN, S. D.—The Aberdeen Railway Company is taking estimates on the cost of constructing a street-car line, four miles of which are to be completed by December 1, 1910. C.

DOUGLAS, WASH.—The Waterville Railway Company has been organized to construct an electric freight and passenger line to Waterville, a distance of five miles. George C. Wiley, secretary and treasurer. C.

TOLEDO, O.—The Northern Ohio Traction & Light Company will build a spur from Wadsworth to Seville, O., connecting with the Cleveland & Southwestern line. It is estimated that the extension will cost in the neighborhood of $300,000. H.

PHILADELPHIA, PA.—The Northern New York Construction Company has been formed at Vineland for the purpose of building a trolley line between Vineland and Bridgeton, the county seat. Dr. G. H. Burgess, of Philadelphia, is among the directors.

ONTARIO, CAL.—Engineer Dunn, of the Pacific Electric Railway Company, of Los Angeles, has asked for a franchise for an electric railway line in the northern part of this city. The proposed line will give an entrance to the new line from Claremont.

STEVENS POINT, WIS.—The survey for the Chicago & Wisconsin Valley Electric Railroad has been started. The first link of the line will be built between Stevens Point and Portage. The chief engineer is Allen T. Russell, of Baltimore, who surveyed the Chicago, Aurora and Elgin road.

BOSTON, MASS.—The Boston & Northern Street Railway Company expects to open its new line through Middlesex Falls in about two months. The route is nearly straight, and will give the quickest connection between Boston and Stoneham that their geographical positions warrant.

MEMPHIS, TENN.—Following the disposition of $350,000 first-mortgage bonds and $87,500 preferred stock, the officials of the Lakeview Traction Company have started the laying of rails for the interurban railway which is to connect Clarksdale, Collierville and Covington with Memphis.

GLENDALE, CAL.—The franchise for the right-of-way along Fourth Street between Glendale and Brand Boulevard, which has been held for the past four years by the Pacific Electric Company, of Los Angeles, has been abandoned by that company and a transfer of franchise will be made to E. D. Goode.

EVANSVILLE, IND.—Capitalists of Chicago held a conference with local men of this city October 21, in the interest of a traction line projected from this city to Olney, Ill. It is the declared intention of the promoters eventually to build the line to Robinson and Bridgeport, Ill., in the Illinois oil belt. S.

PLACERVILLE, COLO.—It is stated that great preparations are being made by the Southern Pacific to continue work this winter on the dam being erected to furnish power for a mammoth electric plant, which will be used by the company in electrification of the lines about the bay. Three camps have been established for the winter and vast quantities of provisions are being installed.

CLARKSDALE, TENN.—Work on the interurban railway between Memphis, Collierville and Clarksdale has been started, the sale of $350,000 first-mortgage bonds and $87,500 preferred stock having been made to a representative of the Mercantile Trust Company, of St. Louis. According to Chief Engineer W. W. Hayden, the road will be ready to receive freight and transportation as far as Lakeview by the 1st of April next year.

DECATUR, ILL.—The Illinois Traction Company has taken out incorporation papers for the two belt lines that they will build at Edwardsville and at Decatur. The capital stock of each is $2,500 and the incorporators are the same for both, namely: George M. Mattis, W. H. Carnahan, Charles Zilly, B. E. Bramble, C. E. Cox, all of Champaign. The work of extending the interurban from Norris to Fairview, Ill., will be commenced at once. The company is building the fences and will commence the grading at once. V.

VINELAND, N. J.—The Northern New York Construction Company has been formed here to build a trolley line between here and Bridgeton. The directors elected are: George E. Stevenson, proprietor of the Baker House here; B. F. Patterson, a trolley magnate of New York; G. H. Burgess, of Philadelphia; Frank Parvin, owner of Parvin's Pond, on the proposed line; H. C. Bartlett, former solicitor of the Borough of Vineland, and T. H. Coggey, retired capitalists, of New York. Mr. Stevenson was made president and Patterson and Parvin vice-presidents; Coggey, secretary, and H. C. Bartlett, treasurer. There has been considerable talk in regard to developing this line, but the

people now feel that it is a sure thing. A survey is being made and the right-of-way solicited. The Hebrew colonies, which will be touched, have subscribed $29,000 worth of stock and held another mass meeting tonight to advance the project.

TOLEDO, O.—The Riggs & Sherman Company is busy surveying the preliminary route of the Columbus-Cincinnati Air Line, which will be exactly one hundred miles long. It will connect Cincinnati with the capital city, and work will be started in the spring. H.

CUMBERLAND, MD.—The contract for the building of a street-car line from Fairmont to Fairview or Amos, W. Va., was awarded to Talbott Brothers, contractors, of Fairmont. The line will be built from Fairview to Federal first, and the route will then be decided upon from Federal into Fairmont. The engineering corps is now at Liberty to push its survey from Fairview to Blacksville to connect with the Waynesburg line.

LEAVENWORTH, KAN.—Work on the new interurban line between Kansas City and St. Joseph, Mo., is now under way, and the two Missouri cities will soon be connected by trolley. J. D. Phillips, a representative of the construction company, states that the construction work is progressing rapidly and that the line has been laid several miles outside of St. Joseph already, one part of which is through a twenty-six-foot cut.

MORRICE, MICH.—Fifty men and twenty teams have been started here to begin work on the grading of the new Saginaw-Lansing interurban road. Morrice is the central point between the two cities and the work will be pushed in both directions. Already a huge boarding camp and stable have been erected to care for the men and horses. North of Morrice the line will be built along the wagon road which leads almost straight to Owosso and from here to Lansing it will parallel the Grand Trunk tracks.

COLUMBUS, O.—Papers have been filed with the secretary of state, increasing the capital stock of the Fostoria & Fremont Railway Company from $10,000 to $300,000. The officers of the company are: President, F. D. Carpenter; vice-president, J. H. Goeke, general manager and the attorney for the Western Ohio; secretary and treasurer, J. D. McDonel. Both the Lake Shore Electric and Western Ohio are to be represented on the board. The new line will be bonded for $250,000 and there will be $150,000 preferred and the same amount of common stock. Of the preferred, $30,000 has been allotted to Fostoria and Fremont in equal amounts, the remainder being sold.

PORTAGE, WIS.—The Chicago-Wisconsin Valley Railroad Company has been organized at Portage to construct an electric interurban line between the towns of Janesville and Merrill, Wis. This proposed road will pass through the towns of Madison, Lodi, Briggsville, Friendship, Grand Rapids, Stevens Point, Wausau and ending at Merrill. It will open up a territory now without electric interurban transportation and a rich farming and stock raising region. It is stated that work will be started at once. The officers of the company are as follows: F. G. Frost, of Stevens Point, president; J. W. Powers, Friendship, first vice-president; J. P. Barnes, Waupaca, second vice-president; A. J. Behmeyer, Indianapolis, secretary; J. F. Jones, Portage, treasurer; F. J. Tynall, Briggsville, assistant treasurer, and Allen Russel, Baltimore, general manager. M.

GUTHRIE, OKLA.—Two railroad companies, the Lawton & Fort Sill Electric Railway Company and the Coffeyville & Nowata Railroad and Power Company, have been granted state charters. The Lawton company has $200,000 capital stock and proposes to build twenty miles of electric railway in Lawton and from Lawton to the Fort Sill military post, Medicine Park and other points in Comanche County. The incorporators are: Simon Smith, of Oklahoma City; J. D. Sleeper, of Lawton; O. L. Sleeper, J. H. Miller and W. H. Pattie, of Tulsa. The Coffeyville & Nowata Railroad and Power Company proposes to build twenty-three miles of railroad from Coffeyville to Nowata. The capital stock of the company is $200,000 and the incorporators are: John D. Pollard, of Kansas City; W. P. Brown, of Coffeyville, Kan., and J. C. Denton, W. V. Thraves and J. A. Tillotson, of Nowata.

ST. LOUIS, MO.—The St. Louis-Kansas City Electric Railroad Company, a $5,000,000 corporation, has obtained a charter at Jefferson City to construct an electric railway to connect the two principal cities of Missouri. St. Louis, Kansas City, Chicago and Denver capitalists are interested in the venture. The capital stock is divided into 50,000 shares, with a par value of $100 each. The road is to be 295 miles long and traverse the counties of St. Louis, St. Charles, Lincoln, Warren, Montgomery, Callaway, Boone, Howard, Saline, Lafayette and Jackson to Kansas City, with a branch line from Glasgow through Charlton to Brookfield, in Linn County. The directors, who are the stockholders, number fifteen, as follows: D. C. Nevins and Charles A. Loomis, Kansas City; H. V. Johnson, W. Weston and B. L. Dorsey, Denver; J. H. Reeder and H. E. Insley, Kansas City; W. A. Hamilton, Chicago; L. M. Nevins and Seldon P. Spencer, St. Louis; George A. Anderson, Denver; W. H. Griffitts, Hays, Kan.; W. B. Cawthorn, Columbia, Mo., and Randall B. Young, Kansas City.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

McINTOSH, S. D.—The Dakota-Montana Telephone Company is building into the city. C.

BEEVILLE, TEX.—The Beeville Light Company has been granted a forty-year franchise here.

HIGBEE, MO.—The Citizens' Electric Light Company has been incorporated, with a capital stock of $5,000.

CHAPPELL, NEB.—The Chappell Telephone Exchange has been incorporated, with a capital stock of $10,000.

ST. PAUL, NEB.—The Howard County Telephone Company has been incorporated, with a capital stock of $100,000.

GRAFTON, N. D.—A rural telephone company has commenced the construction of a telephone system near here. C.

SUMMERFIELD, GUILFORD COUNTY, N. C.—The Farmers' Telephone Company has been incorporated, with headquarters here. L.

CHILLICOTHE, MO.—This city will vote on the issuance of bonds to the amount of $150,000 for waterworks and electric-light purposes.

BARTON, N. D.—A franchise has been granted by the county board to the Barton Farmers' Telephone Company to construct a telephone line. C.

GLADSTONE, MAN.—Fire damaged the building occupied by the government telephone system and other buildings to the amount of $60,000. C.

CRAWFORD, NEB.—The foundation for the Moyer telephone central has been completed and work will shortly be commenced on the superstructure. C.

TONOPAH, NEV.—Edward Clifford has purchased from J. C. McCormick the telephone line from Tonopah to Clifford and will extend it to Ellendale. A.

NORTHFIELD, WIS.—The Northfield Farmers' Telephone Company, H. L. Hanson, secretary, is considering the construction of a telephone line to Merrillan. C.

KAUKAUNA, WIS.—C. E. Raught, E. T. O'Brien and others have incorporated the Kaukauna Telephone Company, with a capital of $5,000, to build several rural lines. C.

NASHVILLE, N. C.—The Home Telephone Company, operating in a number of towns, is completing a new system here. F. C. Topleman is general manager of the Home Company. L.

JACKSON, CAL.—R. W. Barnett, of Lancha Plana, has been granted by the Board of Supervisors the right to erect poles in township No. 2 for the Farmers' Telephone Line, a local association.

SAN FRANCISCO, CAL.—Duncanson & Haroldson, Inc., have been awarded the contract for the substation of the Sierra and San Francisco Power Company in Visitacion Valley, south of San Francisco.

COEUR D'ALENE, IDAHO—The Silverton Engineering Company has been awarded the contract for the construction of the power development plant which will operate the Lehigh Valley Cement Company plant, to be built at Metaline, on the Pond Oreille River.

SAN FRANCISCO, CAL.—Superintendent F. P. Bergen, of the Sacramento Valley Power Company, has placed orders for wires, insulators and poles and all equipment necessary for the construction of a power line between Chico and Redding. A substation will be constructed a few miles out of Chico.

CRAWFORDSVILLE, IND.—The Crawfordsville Home Telephone Company has purchased the Darlington telephone exchange and will extend the system to Garfield. The company will build two new full copper-circuit lines from Crawfordsville to Darlington and make other improvements to the acquired property. S.

RICHMOND, VA.—The corporation commission report of values of public utilities up to June 30, 1909, for taxation for the current year shows that telephone and telegraph companies occupy fifth place in the list, being valued at $2,617,000, while electric railways hold fourth place, with a total valuation of $8,643,000. The total State tax on these items will amount to more than $100,000. L.

OMAHA, NEB.—Officers of the Continental Telephone and Telegraph Company, a recently incorporated independent concern, with an authorized capital of $50,000,000, announce that they have purchased the property of the Independent Union Telephone and Telegraph Company, which operates telephone lines in a territory reaching from Newburgh, N. Y., on the east, to Erie, Pa., on the west. The new owners announce that they will put the property into shape to handle telegraph as well as telephone business.

ELECTRICAL SECURITIES.

In a recent report of the United States Steel Corporation, whose stocks may be regarded as a barometer of financial conditions, the favorable state of the trade in securities was quite well brought out. That this improvement also applies to the electric companies may be seen from some of the following reports:

Business with the telegraph companies, especially in the south, has recently increased to such an extent that it is becoming difficult to secure enough skilled operators to take care of the messages. The telegraph companies are now showing record net earnings.

President Duntley, of the Chicago Pneumatic Tool Company, says that the business has established a high record and is expanding at such a rate as to justify the expectation of dividends at the old basis now and a higher basis later. The management of the Chicago Pneumatic Tool Company states that a resumption of dividends may be expected early in 1910.

The Massachusetts railroad commissioners have approved an issue of 9,850 additional shares of Old Colony Railroad at $195 per share, to pay bonds of the Boston, Clinton & Fitchburg, maturing January 1.

At the annual meeting of the International Traction Company, of Buffalo, Morris Cohn, Jr., and Porter Norton were elected directors, to succeed H. J. Pierce and Arthur Robinson. Other directors were re-elected.

At the annual meeting of the Northwestern Elevated Company, Chicago, directors were re-elected. Directors of the Northwestern Elevated have re-elected the officers.

DIVIDENDS.

American District Telegraph Company; quarterly dividend of one per cent, payable November 15.

Connecticut Railway and Lighting Company; quarterly dividend of one per cent on the common stock and one per cent on the preferred, both payable November 15.

Ohio Traction Company; an initial dividend of one per cent on its common stock; also the regular quarterly dividend of one-and-one-fourth per cent on its preferred stock; both dividends payable November 1 to holders of record October 25.

Pacific Gas and Electric Company; a dividend of $1.50 per share on the preferred stock, payable November 15.

Pensacola Electric Company; semi-annual dividend of $3 per share on the preferred stock; also a dividend of $3 per share on account of deferred dividends accumulated since December 1, 1907, payable December 1 to stockholders of record November 15.

Public Service Investment Company; quarterly dividend of two per cent on preferred, payable November 15.

NEW YORK.

	Nov. 1.	Oct. 25.
Allis-Chalmers common	15⅜	14
Allis-Chalmers preferred	52¾	50
Amalgamated Copper	86⅛	79½
American Tel. & Cable	*80	*80
American Tel. & Tel.	141¼	139⅜
Brooklyn Rapid Transit	75⅝	76½
General Electric	163	159
Interborough-Metropolitan common	19⅝	17⅛
Interborough-Metropolitan preferred	50⅛	48⅜
Kings County Electric	129	128
Mackay Companies (Postal Telegraph and Cables) common	91	90⅛
Mackay Companies (Postal Telegraph and Cables) preferred	75¼	74
Manhattan Elevated	141	141
Metropolitan Street Railway	20	20
New York & New Jersey Telephone	123½	123½
U. S. Steel common	90	86⅝
U. S. Steel preferred	127⅞	126
Western Union	76½	76
Westinghouse common	86	84½
Westinghouse preferred	140	132

*Last price quoted.

BOSTON.

	Nov. 1.	Oct. 25.
American Tel. & Tel.	141¼	139¾
Edison Elec. Illuminating	...	252
General Electric	163	159
Massachusetts Electric common	18¼	16½
Massachusetts Electric preferred	82	...
New England Telephone	134	134½
Western Tel. & Tel. common	10½	10
Western Tel. & Tel. preferred	88	88

PHILADELPHIA.

	Nov. 1.	Oct. 25.
American Railways	45½	45½
Electric Company of America	12¼	12⅜
Electric Storage Battery common	58	59½
Electric Storage Battery preferred	58	59½
Philadelphia Electric	13¼	12⅞
Philadelphia Rapid Transit	25¾	25½
Philadelphia Traction	89½	89¼
Union Traction	51¾	52

CHICAGO.

	Nov. 1.	Oct. 25.
Chicago Railways, Series 1	104	107
Chicago Railways, Series 2	35	35
Chicago Subway	7	7¼
Chicago Telephone	136	136½
Commonwealth Edison	119	119½
Metropolitan Elevated common	16	17
Metropolitan Elevated preferred	50	50
National Carbon common	95½	95¾
National Carbon preferred	118	118

PERSONAL MENTION.

FRED L. BAER has become superintendent of equipment for the Home Telephone Company, of San Francisco.

C. F. ELWELL, who has acquired the American rights for the Poulsen system of wireless telegraph and telephone, has returned to San Francisco from Europe and has opened offices in the Foxcroft Building there. A.

W. A. LAYMAN, vice-president and general manager of the Wagner Electric Manufacturing Company, of St. Louis, Mo., was a prominent attendant at the convention of the National Metal Trades Association held at Cleveland last week. Mr. Layman finds a very satisfactory condition of affairs throughout the entire metal industry and reports the Wagner Electric Manufacturing Company very busy and extremely well satisfied with its share of orders.

E. C. SORNBORGER has become identified with the Allis-Chalmers Company, of Milwaukee, Wis., in the capacity of sales engineer in its pumping engine and hydraulic turbine department. Mr. Sornborger received his early training and practical experience in the shops of the United States Navy, where he was later appointed a cadet engineer. Shortly after he was enlisted in the merchant service as assistant engineer, in which position he remained for a number of years. Attention has frequently been called to the value of the Navy as an industrial school, and this is reflected in the engineering career of Mr. Sornborger; while his subsequent work with the Buffalo Steam Pump Company, the Gordon Steam Pump Company and the Snow Steam Pump Works emphasizes its value commercially. Lieutenant Sornborger still retains his interest in naval affairs, being the commanding officer of a division of the Naval Militia of Buffalo.

OBITUARY.

GEORGE O. LINES, fifty-two years old, who formerly owned the street-railway line between Bridgeport and Stratford, Conn., died on October 26, at Stratford.

NEW PUBLICATIONS.

PREVENTION OF ACCIDENTS, OR A SAFER AMERICA—The Museum of Safety, of New York city, has recently published copies of a lecture by Dr. William H. Tolman entitled "Prevention of Accidents, or A Safer America." Dr. Tolman explains the causes for many of the accidents so frequent in manufacturing plants and outlines methods of preventing them.

UNITED STATES NAVAL INSTITUTE PROCEEDINGS—The September number of this quarterly, published by the Institute at Annapolis, Md., has just come to hand. Among other articles are the following: "Some Notes on Parsons Turbine Construction," by Captain A. B. Willits, U. S. N., "On the Approximate Formulas for Areas and Volumes, and Their Comparative Accuracy," by W. Woolsey Johnston, and "Main Engine Repairs Under Way," by Lieut. E. C. Kalbfus, U. S. N.

ELECTRIC MEASURING INSTRUMENTS—Circular No. 20, issued by the Bureau of Standards, Washington, D. C., entitled "The Testing of Electrical Measuring Instruments," gives, in addition to the list of fees for testing instruments, an outline of the characteristics of the various types of instruments now commercially used. The descriptive matter covers ammeters, voltmeters, wattmeters, watt-hour meters, recording meters and instrument transformers. The subjects of "Sources of Error," "The Liability of Electrical Instruments" and "Apparatus for Checking Instruments" are fully discussed.

THE HUDSON-FULTON CELEBRATION—A series of thirty-two illustrations prepared chiefly from photographs of the New York Edison Company, illustrating the lighting effects accompanying the Hudson-Fulton Celebration in New York city, has been published in pamphlet form. It formed part of an illustrated address before the Franklin Institute, of Philadelphia, which was delivered by Arthur Williams, of the New York Edison Company, on the evening of October 20. The illustrations are from excellent engravings and give a very good idea of the grandeur and magnitude of the lighting display which attracted hundreds of thousands of people to New York city. A number of the illustrations appeared in the columns of this journal in recent issues.

STATE REGULATION OF PUBLIC UTILITIES—The address of John H. Roemer, member of the Railroad Commission of Wisconsin, which was delivered before the Wisconsin State Bar Association at its meeting on September 1 in Milwaukee, has been reprinted in pamphlet form. The title of this address is "Some Features of State Regulation of Public Utilities." After a general introduction on the broad principles underlying government control the speaker dwelt at some length on the organization and work of the Railroad Commission of Wisconsin, which is the public service body of that state. This is a valuable address in pointing out the working of the Wisconsin public utility law, which is one of the broadest and most equitable on this subject ever enacted in any of the states.

PROPOSALS.

POST OFFICE, BELLEVILLE, ILL.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 16 for the construction (including plumbing, gas piping, heating apparatus, electric conduits and wiring) of the United States Post Office at Belleville, Ill., in accordance with the drawings and specifications, copies of which may be had from the custodian of the site at Belleville, Ill., or at the Supervising Architect's office.

POST OFFICE, ROCK ISLAND, ILL.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 18, 1909, for the construction (including plumbing, heating, wiring and standard clock system) of the extension of the United States Post Office at Rock Island, Ill., in strict accordance with drawings and specification, copies of which may be had at the office of the custodian at Rock Island, Ill., or at the Supervising Architect's office.

POST OFFICE AND CUSTOM HOUSE, NEW HAVEN, CONN.—The office of the Supervising Architect, Washington, D. C., will receive sealed proposals until November 15 for the construction (including plumbing, gas piping, heating apparatus, electric conduits, wiring, and lifts) of an extension, remodeling, etc., to the United States Post Office and Custom House, New Haven, Conn., in accordance with drawings and specifications, copies of which may be obtained from the custodian at New Haven, Conn., or at the Supervising Architect's office.

INDUSTRIAL ITEMS.

THE PACIFIC ELECTRIC HEATING COMPANY, Ontario, Cal., is distributing a novel booklet devoted to electric irons.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Rochester, N. Y., has recently distributed Bulletin No. 1000, devoted to mine telephones.

THE CENTRAL ELECTRIC COMPANY, 264-270 Fifth Avenue, Chicago, announces that hereafter it will make no extra charge for packing and cartage except on fixtures and glassware.

I. P. FRINK, 551 Pearl Street, New York city, has just been awarded the grand prize for reflectors by the Alaska-Yukon-Pacific Exposition. Any problem regarding the illumination of hotels, stores, picture galleries or public buildings is solved by this concern.

THE CUTLER-HAMMER MANUFACTURING COMPANY, of Milwaukee, Wis., has recently issued a folder devoted to pressure-controlled speed regulators for use with boiler-draft fans, boiler-feed pumps, gas-pressure systems, etc. This publication contains some valuable data.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., describes at some length, in Bulletin No. 1614, recently issued, the Manhattan high-pressure, fire-service system as operated by Allis-Chalmers six-stage, centrifugal, fire-service pumps, driven by Allis-Chalmers induction motors.

THE D & W FUSE COMPANY, Providence, R. I., has recently distributed bulletins Nos. 112 and 113. Bulletin No. 112 is devoted to a description of service switches and fuse boxes for national code fuses for 250 and 600 volts. Bulletin No. 113 describes fuses and cut-outs for inductive circuits.

THE CENTRAL ELECTRIC COMPANY, CHICAGO, ILL., is distributing a new circular descriptive of the new Central type weighted push button, for which several advantages are claimed, also a new folder descriptive of guy anchors, which should prove of interest to central-station managers. Copies of these publications will be sent on request.

THE NERNST LAMP COMPANY, Pittsburg, Pa., is sending out a folder to central-station companies calling their attention to the excellent returns made by putting out Nernst lamps free. A comparison is drawn between the revenue derived on this basis and the revenue obtainable from the renting of tungsten lamps, giving very closely the equivalent illumination.

THE BRISTOL COMPANY, Waterbury, Conn., has recently issued the following bulletin No. 108, devoted to William H. Bristol indicating electric pyrometers for hardening furnaces; No. 112, devoted to Bristol recording thermometers; No. 113, devoted to Bristol patent steel belt lacing, and No. 115, devoted to indicating and recording units of William H. Bristol electric pyrometers for annealing furnaces.

THE OHIO BRASS COMPANY, Mansfield, Ohio, is very busy on some large orders for 110,000 and other high-voltage link-type insulators for the Ontario Hydroelectric Commission, for the Helena (Mont.) Water Power, Land and Townsite Company and for a number of other projects developing and transmitting electricity at high voltages. A representative of the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN witnessed, in the company of a number of prominent electrical engineers from Indianapolis, a 200,000-volt test of these insulators at the Akron works of the Ohio Brass Company last week.

F. B. BADT & COMPANY, Suite 1504 Monadnock Building, Chicago, Ill., electrical engineers and western selling agents for Weston electrical instruments and Ward Leonard rheostats, reports a constantly increasing demand for these well-known lines. F. B. Badt & Company's business, so far this year, has made such strides that the total business for the year bids fair to equal the best year in the company's history.

THE ANDERSON CARRIAGE COMPANY, Detroit, Mich., has absorbed the Elwell-Parker Electric Company, Cleveland, Ohio, and will take over the entire electrical and mechanical product of this well-known and old-established company. The Anderson Carriage Company will increase its line of taxicabs, trucks and other electric carriages. M. S. Towson will remain in Cleveland as general manager and consulting engineer.

THE JOHN A. ROEBLING'S SONS COMPANY, Trenton, N. J., has received ten grand prizes, the highest awards, for its exhibit at the Alaska-Yukon-Pacific Exposition. A grand prize was awarded the company for its general exhibit and similar prizes were bestowed for different articles shown. Among the Roebling products thus honored were iron telephone and telegraph wire; steel, brass and copper wire, and insulated wires and cables.

THE ADAMS-BAGNALL ELECTRIC COMPANY, Cleveland, Ohio, is very busy on orders for the Adams-Bagnall regenerative flame arc lamp. H. J. Worbs, secretary of the company, is enthusiastic over the reception which has been accorded this new lamp and states that out of a large number of shipments which have already been tested out, an entirely satisfactory showing has been made and that repeat orders are coming in in considerable volume.

THE ELECTRIC CONTROLLER AND MANUFACTURING COMPANY, Cleveland, Ohio, manufacturer of electric controllers, has recently issued a catalogue devoted to lifting magnets. This company's ten years' experience in developing lifting magnets has enabled it to place on the market a magnet that fulfills all conditions as they exist in practice. In addition to convincing arguments the catalogue contains some data and illustrations that should prove beneficial to those interested in the subject.

THE WHEELER REFLECTOR COMPANY, 156 Pearl Street, Boston, Mass., is distributing a folder which shows in a simple yet striking manner the advantages of the Wheeler fluted reflector for tungsten street fixtures. In comparison with the ordinary convex reflector for this purpose it is shown to give about twenty-three per cent more useful light, *i. e.*, below the horizontal. These reflectors have become very popular for this service since they were placed on the market some eighteen months ago.

THE NATIONAL METAL MOLDING COMPANY, of Pittsburg, Pa., is distributing a set of illustrated post-cards showing the new terminal station for the Chicago & Northwestern Railway at Chicago. This building covers an area of about ten acres, and with the attendant track changes which were necessitated by its construction will, when completed, have cost over $20,000,000. It has a capacity to handle over quarter of a million passengers per day. Throughout this beautiful depot exclusive use is made of "Sherarduct" rust-proof, non-corrosive conduit, made by this company.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has just published Bulletin 116, which gives some points on the operation and care of Exide vehicle batteries. This bulletin is really a reprint of a paper read by H. M. Beck, engineer of the operating department of the company at Chicago, before the recent convention of the Society of Automobile Engineers. The details of the particular methods of charging and the general care of the batteries are not given exhaustively, but the general principles are laid down in a very clear manner, and the principal points that are the cause of trouble are explained at some length.

THE GENERAL ELECTRIC COMPANY reports very gratifying sales of tantalum incandescent lamps. The sales of this lamp are more than double what they were a year ago and the lamp appears to be sharing with the demand for high-efficiency lamps created by the introduction of tungsten lamps. The tantalum lamp, as at present supplied, is giving most excellent life service. Contrary to general belief, these lamps will give good commercial life on alternating current of sixty cycles or less. Their life on this frequency will average well above 600 hours. An interesting tantalum-lamp order recently received called for 1,900 lamps for the United States war vessels attending the Hudson-Fulton Celebration in New York city.

THE ALLIS-CHALMERS COMPANY, Milwaukee, Wis., announces that during the month of September it shipped a total of twenty-one steam turbines, none of which were of less capacity than 300 kilowatts. Although this figure does not represent a record of shipments, it nevertheless serves to give a fair idea of the large number of Allis-Chalmers steam turbines being placed in operation at various points throughout the country. The following is a list of September shipments, a number of which include more than one unit to a customer and some

of which will augment previous installations of machines from the same builders: Industrial Works, Bay City, Mich.; Lowland Worsted Company, Woonsocket, R. I.; Anderson & Middleton Lumber Company, Aberdeen, Wash.; Noblesville Heat, Light and Power Company, Noblesville, Ind.; North Adams Gas Light Company, North Adams, Mass.; Nashawena Mills, New Bedford, Mass.; Clinton Sugar Refining Company, Clinton, Iowa; Fraser River Lumber Company, Fraser Mills, B. C.; National Conduit and Cable Company, Hastings-on-Hudson, N. Y.; City of Columbus, Columbus, Ohio; Oak Park Power Company, Flint, Mich.; Merchants' Light, Heat and Power Company, Indianapolis, Ind.; Northwestern Gas and Electric Company, Walla Walla, Wash.; Eastern Pennsylvania Railway Company, Pottsville, Pa.; Wilkesbarre Gas and Electric Company, Wilkesbarre, Pa.; Colorado Springs Electric Company, Colorado Springs, Colo.; Royal Weaving Company, Pawtucket, R. I., and Virginia Electric Power and Water Company, Virginia, Minn. A considerable percentage of the above represents low-pressure units for use in connection with existing high-pressure steam plants.

DATES AHEAD.

National District Heating Association. First annual meeting, Columbus, Ohio, November 10 and 11.

Alabama Light and Traction Association. Annual convention, Birmingham, Ala., November 15 and 16.

American Association of Electric Motor Manufacturers. Next meeting, St. Louis, Mo., November 15 to 18.

Boston Electrical Show. Mechanics' Building, Boston, November 15-25.

Empire State Gas and Electric Association. Annual convention, New York city, November 17 and 18.

Ohio Society of Mechanical, Electrical and Steam Engineers. Annual meeting, Lima, Ohio, November 19 and 20.

International Independent Telephone Association. Annual convention, Chicago, December 7, 8 and 9.

RECORD OF ELECTRICAL PATENTS.

Issued (United States Patent Office) October 26, 1909.

937,759. PROCESS OF AND APPARATUS FOR THE PRODUCTION OF IONS. Lucien I. Blake, Denver, Colo. Filed May 16, 1908. The ions are produced and delivered into the air by being electrically charged by an external source of electromotive force in the flame, etc., in which they are developed by dissociation.

937,761. TROLLEY. Orson W. Brenizer, Philadelphia, Pa., assignor of one-third to James Franklin and one-third to Charles G. Wilfong, Philadelphia, Pa. Filed April 21, 1905. The harp has as an extension a bifurcated guard.

937,832. TELEPHONE-EXCHANGE SYSTEM AND APPARATUS. Ray H. Manson, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Filed November 15, 1904. A combined signal and cut-off magnet having two windings, one on each limit, can be energized to close or to open the local signal circuit.

937,839. AIR-BRAKE. Lorenzo E. Morel, St. Hyacinthe, Quebec, Canada. Filed July 14, 1909. The exhaust is electrically controlled.

937,855. PROCESS OF PRODUCING AND REFINING STEEL. Frank C. Perkins, Buffalo, N. Y. Filed May 11, 1908. An iron bath is treated by an electric current which traverses an electrode containing iron in the presence of the iron bath and a slag-producing medium is supplied at the arc from this electrode.

937,857. PENDANT SWITCH. Johann G. Peterson, Hartford, Conn., assignor to the Arrow Electric Company, Hartford, Conn. Filed January 5, 1909. Describes a form of double-acting push-button switch.

937,858. COMBINED LAMP-SOCKET AND AUTOMATIC SWITCH. James W. Phelps, Detroit, Mich., assignor to the Electro-Ad Company, Detroit, Mich. Filed December 31, 1908. Includes a thermodynamic switch.

937,859. MOTOR-VEHICLE. Henri Pieper, Liege, Belgium. Filed January 25, 1907. Describes a form of gaso-electric vehicle with a reversible dynamo-motor and an auxiliary storage battery.

937,867. STRAIN-INSULATOR FOR ELECTRIC LINES. Edward E. Rose, Swissvale, Pa., assignor to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed January 10, 1908. Has an outer casing yieldingly secured to the strain members so as not to be subjected to strain itself.

937,877. TRANSFORMER. Frank M. Slough, Elyria, Ohio, assignor to Dean Electric Company, Elyria, Ohio. Filed September 11, 1907. A signaling system includes a pole changer to supply current intermittently to the primary winding of a transformer, the secondary winding being connected to the signaling apparatus, and a reactive means is automatically included in circuit with the secondary winding when current is delivered from the latter.

937,897. STRAIN-INSULATOR. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed January 10, 1908. Similar to No. 937,867.

937,901. TELEPHONE REPEATER APPARATUS. Nathaniel G. Warth, Gallipolis, Ohio. Filed December 20, 1907. The transmitter includes a case and a vibrating diaphragm united to form a granule-containing chamber, the arrangement being devised so as to promote free movement of the granules and eliminate packing.

937,908. SPARK-PLUG. Otto C. Winestock, Perkinsville, Vt. Filed September 1, 1908. The (movable) inner electrode has a disklike head of crenelated outline.

937,909. METHOD OF WIRING TELEPHONE-SWITCHBOARDS. Charles S. Winston, Chicago, Ill., assignor to Kellogg Switchboard and Supply Company, Chicago, Ill. Filed December 27, 1904. The cord circuits may be differently grouped by connecting terminals in various ways.

937,918. ELECTROLYTIC APPARATUS. Arthur Brichaux, Brussels, Belgium, assignor to the Solvay Process Company, Syracuse, N. Y. Filed October 4, 1898. The electrodes are arranged respectively in contact with layers of non-miscible electrolytes of differing densities.

937,919. ELECTRIC ALARM. Ralph C. Bronson, Chicago, Ill. Filed October 12, 1908. Relays in local circuits have associated with them a ringer circuit for each relay, etc.

937,941. ELECTRIC PROTECTION SYSTEM. Ole Jacobson, Hamilton, Ohio. Filed November 23, 1908. Describes an electric protective system for the combination lock of a safe.

937,957. ELECTRIC-SWITCH MECHANISM. Johann G. Peterson, Hartford, Conn., assignor to the Arrow Electric Company, Hartford, Conn. Filed December 10, 1908. Describes a form of commutator for a rotatory snap electric switch.

937,971. STARTING DEVICE FOR VAPOR-CONVERTERS. Percy H. Thomas, Montclair, N. J., assignor to Cooper Hewitt Electric Company, New York, N. Y. Filed May 11, 1905. The cathode activity produced by causing current to flow in the rectifier in a direction opposite to normal is utilized to overcome the starting resistance of the normal cathode.

937,984. INSULATOR-BRACKET. Edward V. Brown, New Albany, Ind., assignor of one-half to Adolph Day, New Albany, Ind. Filed February 27, 1909. A vertical insulator is supported by horizontal arms projecting from and integral with a wall plate.

938,026. LOCKING AND SIGNALING SYSTEM FOR TELEPHONE-REGISTERS. Alexander S. Spiegel, Chicago, Ill., assignor to American Telephone and Telegraph Company. Filed June 10, 1907. A device having differential windings controls one of the meters, the current distribution in these windings being varied by a resistance-varying device governed by another of the meters.

938,030. LATHE HEAD-STOCK. Harry B. White and Perry E. Medford, Washington, D. C. Filed March 26, 1908. The headstock includes an electric motor direct-coupled to the live spindle or mandrel.

938,038. INCANDESCENT LAMP-SOCKET. Homer A. Bretz, Chicago, Ill., assignor to the Federal Electric Company, Chicago, Ill. Filed March 4, 1907. Renewed March 5, 1909. The socket includes an electromagnet in series with the lamp circuit.

938,039. APPARATUS AND SYSTEM FOR MEASURING TELEPHONE SERVICE. Sidney H. Browne, Pittsburg, Pa., assignor to American Telephone and Telegraph Company. Filed January 17, 1905. Includes a line switch (connected to a meter) adapted to select automatically an idle trunk line, and electromagnetic means automatically operating the meter by a single energization to register only connections with other telephone lines.

938,060. APPLIANCE FOR USE WITH TELEPHONE-TRANSMITTERS. Charles J. Kintner, New York, N. Y., assignor to

the Miniature Telephone Booth Company, New York, N. Y. Filed June 1, 1909. A transmission tube, pivotally secured to a vertical standard which frictionally secures it to the supporting standard of a portable telephone set, surrounds and encloses the mouth of the transmitter.

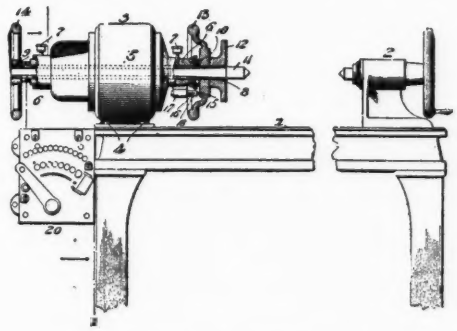
938,092. STRAIN-INSULATOR. Theodore Varney, Pittsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company. Filed June 8, 1907. Renewed June 24, 1909. Comprises a metal tube having taper ends, taper metal bushings seated therein, and taper metal plugs located within, and insulated from, the bushings.

938,108. SPARK-PLUG. William S. Bechtold, Newark, N. J. Filed June 24, 1909. A bent sparking terminal attached to the socket associates with a straight sparking pin located centrally through the plug.

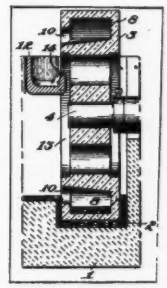
938,123. ELECTRIC IGNITER FOR GAS-ENGINES. James A. Charter, Chicago, Ill., assignor to Austin Manufacturing Company, Chicago, Ill. Filed July 28, 1908. Normally closed electrodes are separated by a trip-released spring-actuated mechanism.

938,127. ELECTRIC HEATER. Harry W. Denhard, San Francisco, Cal., assignor to George B. Katzenstein, Jr., San Francisco, Cal. Filed June 25, 1908. The liquid contained in a fluid chamber is heated by its own resistance to a current of electricity.

938,137. LIGHTNING-ROD. Julius F. Goetz, Hartford, Wis. Filed April 6, 1908. Overlapping tube sections in electrical contact are joined at their ends by threaded plugs and sleeves.



938,030.—LATHE HEAD-STOCK.



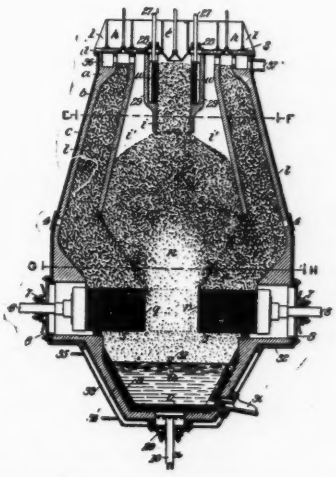
938,191.—CIRCULATING DEVICE FOR MERCURY.

938,191. CIRCULATING DEVICE FOR MERCURY. Jasper Whiting, Boston, Mass., assignor to the Whiting Company, Boston, Mass. Filed December 16, 1908. In combination with the decomposing and oxidizing compartments of an electrolytic cell having a cathode of mercury, is a circulating device for mercury comprising a disk or cylinder mounted for rotation, pockets for mercury in the peripheral portion of this disk, lateral discharge orifices for the pockets, and a receptacle for mercury in proximity to the discharge orifices in their uppermost position.

938,203. ELECTRIC DETONATOR. George A. Allen, Western Springs, Ill., assignor to the Ætna Powder Company, Chicago, Ill. Filed May 26, 1909. Electric wires for the igniting member lead into the shell containing the explosive through a cap which is crimped to exclude moisture.

938,212. ELECTRIC-LAMP-SOCKET FASTENING. Hjalmar Christensen, Seattle, Wash. Filed December 3, 1908. One side of a clamping member for the socket is formed into a cam surface.

938,213. ELECTRIC-LAMP-SOCKET RETAINER. Hjalmar Christensen, Seattle, Wash. Filed March 29, 1909. Similar to the preceding.



938,351.—ELECTRIC SMELTING FURNACE.

938,142. ATTACHMENT FOR MUSICAL INSTRUMENTS. Hermann Günther, Leipzig-Gohlis, Germany. Filed October 10, 1908. Translucent bands on a rotatable picture drum are electrically illuminated when contacts are made by the rotatable shaft of the drum.

938,154. TELEPHONE SYSTEM. Oscar M. Leich, Genoa, Ill., assignor to Cracraft-Leich Electric Company, Genoa, Ill. Filed June 19, 1908. A number of telephone instruments are associated with a metallic circuit (provided with continuity-maintaining repeating coils); a number of groups of telephones arranged tandemwise are also associated with the circuit so that intercommunication may be held between the telephones of each group; and repeating coils are provided for preventing telephonic intercommunication between the first aforesaid telephones and the grouped telephones.

938,155. SIGNALING SYSTEM. Oscar M. Leich, Genoa, Ill., assignor to Cracraft-Leich Electric Company, Genoa, Ill. Original application filed December 10, 1908. Divided and this application filed February 15, 1909. Describes a form of telephone system.

938,160. SYSTEM OF ELECTRIC-MOTOR CONTROL. Joseph N. Mahoney, Wilkinsburg, Pa., assignor to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed January 10, 1908. The trolley and a gathering reel (adapted to receive energy from a supply circuit) for the controller are connected by two independently operated switches which are automatically prevented from being simultaneously closed.

938,175. ELECTRICALLY-OPERATED RELEASE FOR DOORS. William H. Snyder, Ashbourne, Pa. Filed April 6, 1909. A retaining device opposing a means which tends normally to move a bolt to unlocked position, is electrically controlled, and a means operated by the energization of an alarm circuit is provided for closing the (normally) open circuit which controls the retaining device.

938,188. SPARK-PLUG. Fred H. Weinhauer, New York, N. Y. Filed May 11, 1909. Has a shell electrode co-operating with an electrode projecting laterally from a pin disposed axially and centrally through the plug.

938,237. ELECTRICALLY-OPERATED WATER-HEATER. John A. Hunnewell, Lowell, Mass. Filed April 4, 1908. The electrical heating coil is contained in a U-shaped receptacle for the water to be heated.

938,238. ELECTRIC ATTACHMENT-PLUG. Seykichi W. Ito, San Francisco, Cal. Filed March 18, 1909. Describes an attachment plug for lamp sockets.

938,260. INCUBATOR. Edward A. Maisch, Anderson, Cal. Filed January 23, 1909. Includes electric heating coils.

938,271. METALLIC INCUBATOR. Frank C. Perkins, Buffalo, N. Y., assignor to Cyphers Incubator Company, Buffalo, N. Y. Filed August 28, 1908. The egg tray is supported under an electric heater.

938,285. ELECTRIC-SIGNAL RECORDER. Nathan H. Suren, Needham, Mass., assignor to the Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed October 16, 1908. The tool for cutting the tape has an inverted triangular pyramidal end.

938,286. ELECTRIC-SIGNAL RECORDER. Nathan H. Suren, Needham, Mass., assignor to the Gamewell Fire-Alarm Telegraph Company, New York, N. Y. Filed May 14, 1909. The marker is adapted to cut slots of varying lengths in the recording tape to form tongues and means are provided for severing the tongues so formed.

938,312. BATTERY. William Gardiner, Chicago, Ill., assignor to Ajax Battery Company, Chicago, Ill. Filed February 17, 1908. Molybdenum enters into the composition of the anode, or the cathode, or both.

938,313. STRAIN-RELIEF FOR ELECTRICAL DEVICES. Gilbert W. Goodridge, Bridgeport, Conn., assignor to the Bryant Electric Company, Bridgeport, Conn. Filed June 30, 1908. An electrical device has an insulating body and terminal plates with a strain-relief comprising binding screws and clamping strips to embrace and grip the insulated portions of the wires adjacent to the binding screws, the latter securing the clamping strips.

938,324. AUTOMATIC CIRCUIT-BREAKER. Joseph N. Kelman, Los Angeles, Cal. Filed April 22, 1907. Describes a form of high-potential switch and circuit-breaker.

938,331. BLOCK-SIGNAL SYSTEM. John D. Nix, Ferriday, La., assignor of one-fourth to Lewis M. Dalgarn, Natchez, Miss. Filed September 11, 1908. Each engine is provided with a dynamo and motor, the shaft of the latter being adapted to open a valve which controls a pair of cylinders provided with pistons, one of which operates a brake lever and the other a throttle valve. The motor is caused to operate by the approach of another engine in the same block.

938,337. TELEGRAPHY. John F. Richardson, Montreal, Quebec, Canada. Filed January 11, 1907. A pivoted member closes a local circuit when released from the electrical pull of an arc-shaped solenoid.

938,345. ELECTRICAL SIGNALING SYSTEM. Frank M. Slough, Elyria, Ohio, assignor to the Dean Electric Company, Elyria, Ohio. Filed June 19, 1906. Describes such a system, including a central station and a number of subscribers' stations.

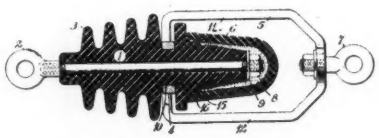
938,351. ELECTRIC SMELTING-FURNACE. Edward R. Taylor, Penn Yan, N. Y. Filed June 12, 1908. Has concentric feed passages discharging together in the zone between horizontal electrodes in the lower part of the furnace.

938,352. ART OF ELECTRIC SMELTING. Edward R. Taylor, Penn Yan, N. Y. Original application filed June 12, 1908. Divided and this application filed March 3, 1909. Similar to the preceding.

938,354. TYPEWRITER ATTACHMENT. Webster A. Tompkins, Portland, Ore. Filed August 26, 1905. The keys when depressed make electrical contacts for a solenoid, the core of which operates a rockshaft.

938,368. ELECTRIC CIGAR-LIGHTER. Solomon A. Campbell, Newton, Mass., assignor of one-half to John R. Learned, Newton, Mass. Filed August 14, 1908. Has one movable and one relatively fixed electrode.

938,373. PROTECTING-BOX FOR ELECTRIC WIRING. Harold W. Eden, Detroit, Mich., assignor to P. R. Manufacturing Company, Detroit, Mich. Filed December 16, 1908. Slots extending the body of the box are notched along the edges and on opposite sides of the walls of the box, and a correspondingly shaped fillet engages with the notches.



938,409.—STRAIN-INSULATOR.

938,394. CIRCUIT CLOSING AND BREAKING DEVICE FOR ELECTRICALLY-OPERATED ANNUNCIATORS AND THE LIKE. Augustus May, New Orleans, La. Filed March 25, 1909. Pivotally mounted weighted arms are electrically connected to a conductor, and a device carried by the car has insulated contact means which engage respective arms during the travel of the car.

938,399. ELECTRICAL EXERCISING APPARATUS. Walderma C. Schaufler, Amsterdam, N. Y. Filed July 9, 1908. The elastic cords of the apparatus comprise electric conducting means associated with a source of current and an induction coil, etc.

938,409. STRAIN-INSULATOR. Curtis F. Boldman, Canton, N. C., assignor to Westinghouse Electric and Manufacturing Company, East Pittsburg, Pa. Filed April 22, 1908. A strain rod extends completely through an insulating sleeve, around which is clamped a strain member.

938,414. CONFECTIONER'S MELTING-TABLE. George F. Dickson, Chicago, Ill., assignor to Confectioners' and Bakers' Supply Company, Chicago, Ill. Filed October 19, 1908. An open-top heating chamber is adapted to contain water, which is electrically heated.

938,429. MECHANISM FOR DANGER-SIGNALS FOR RAILROADS. Roy E. Murphy, Colorado Springs, Colo. Filed September 16, 1907. A torpedo magazine is electrically operated.

938,441. MESSAGE-RECORDING APPARATUS. Francis A. Skelton, Newton, Mass. Filed October 28, 1908. Has an electrically-operated carrier.

938,445. GLASS STORAGE-BATTERY CASE. Frank L. O. Wadsworth, Sewickley, Pa., assignor to Pressed Prism Plate Glass Company, New York, N. Y. Filed July 27, 1907. Opposite sides of the cells are formed of glass plates having ribs of trapezoidal section, the thin edges of the ribs outermost from the plates.

938,451. PROCESS OF MAKING ACTIVE MATERIAL FOR STORAGE-BATTERY ELECTRODES. Jonas W. Aylsworth, East Orange, N. J., assignor to Edison Storage Battery Company, West Orange, N. J. Original application filed April 28, 1905. Divided and this application filed February 6, 1908. The active material consists of nickel peroxide electrolytically deposited from a cyanide solution of the metal.

REISSUE.

13,027. ELECTRIC FURNACE. Aldus C. Higgins, Worcester, Mass. Filed October 12, 1908. Original No. 856,061, dated June 4, 1907. A number of electrodes depend into a relatively long and narrow furnace chamber, the walls of which are cooled by means of a cooling medium in order to effect the production of a commercially uniform product in the furnace.

PATENTS THAT HAVE EXPIRED.

Following is a list of electrical patents (issued by the United States Patent Office) that expired November 1, 1909:

485,181. DYNAMO. William H. Elkins, Cambridge, Mass.

485,220. DYNAMO-ELECTRIC MACHINE. David Pepper, Jr., Philadelphia, Pa.

485,221. AUTOMATIC GOVERNING DEVICE FOR ELECTRIC PUMPS. Francis A. Pocock, Lynn, Mass.

485,238. DEVICE FOR TREATING PATIENTS BY ELECTRICITY. Edmund M. Thomas, Little Rock, Ark.

485,239. REGULATOR FOR DYNAMO-ELECTRIC MACHINES. Elihu Thomson, Lynn, Mass.

485,252. UNDERGROUND ELECTRIC TROLLEY SYSTEM. Ruben B. Ayres, New York, N. Y.

485,279. COMBINED TELEGRAPHY AND TELEPHONY. Wm. W. Jacques, Newton, Mass.

485,284. ARMATURE CORE FOR ELECTRIC MOTORS AND DYNAMOS. Anton J. Lehman, New York, N. Y.

485,287. ELECTRIC LIGHTING SYSTEM. William H. McKay, Roanoke, Va.

485,293. ELECTRIC ARC LAMP. John A. Mosher, Chicago, Ill.

485,297. SIGNAL BELL. Englebrecht Olsen, Walkerville, Mont.

485,311. TELEPHONE. Anthony C. White, Boston, Mass.

485,319. GALVANIC BATTERY. Walter A. Crowdus, Memphis, Tenn.

485,327. ELECTRIC ARC LAMP. Edward R. Knowles, Middletown, Conn.

485,334. ELECTROMAGNETIC TELEGRAPH APPARATUS. Alfred G. Safford, Washington, D. C.

485,337. CIRCUIT SWITCH. Marvin E. Sullivan and John Doss, Denver, Colo.

485,343. METHOD OF AND APPARATUS FOR ELECTRO-DEPOSITION OF METALS. Charles R. Fletcher, Boston, Mass.

485,347. ELECTRIC ARC LAMP. Henri Japy, Beaucourt, and Oscar Helmer, Paris, France.

485,352. ELECTRIC SIGNAL. George McIntosh, Stonington, Conn.

485,367. ELECTRICAL DOOR-TRIP FOR ENGINE HOUSES. Adam Bosch, Newark, N. J.

485,379. ELECTRIC BELL. John R. Hard, New York, N. Y.

485,424. ELECTRICAL HEATER. Henry G. O'Neill, Louisville, Ky.

485,425. ELECTRIC INTERMUTATOR. Henry G. O'Neill, Louisville, Ky.

485,473. ELECTRIC DANGER SIGNAL FOR MOVING TRAINS. James McCart and Arthur G. Judkins, Trenton, Mich.

485,478. INCANDESCENT ELECTRIC LAMP. Edward Pollard, Cambridge, Mass.

485,537. ELECTRICAL ARC LAMP. Edgar A. Edwards, Cincinnati, Ohio.

485,555. UNDERGROUND ELECTRIC CONDUIT AND TROLLEY BAR FOR ELECTRIC RAILWAYS. John S. Moss, Martinsburg, W. Va.

485,558. ELECTRIC SWITCH. James C. O'Neil, Cleveland, Ohio.

485,587. SOCKET FOR INCANDESCENT ELECTRIC LAMPS. John S. Potter, Newton, and David J. Cartwright, Boston, Mass.